14th International Conference on Plastination - July 20-26, 2008

Plastination – quixotic adventure to public science. ***Whalley A***. *Institute for Plastination, Heidelberg, Germany.*

Plastination, a vacuum-forced impregnation technique with reactive polymers for biological specimens, was invented and patented by Gunther von Hagens at Heidelberg University in 1977. But plastination technology only gained wide acceptance after further progressive developments which included the development of suitable polymer systems, the technique of gas curing for silicone impregnated plastinates, the creation of polymerizing emulsions for hard and opaque plastinates, sheet plastination resulting in transparent body slices (patented in 1982), sheet plastination of brain slices and plastination of large specimens including whole body specimens. The 1st International Congress of Plastination was organized by Harmon Bickley in 1982 at Texas Tech University in San Antonio, USA. Martin Lischka, at the Anatomical Institute of the University in Vienna Austria was an early exponent of plastination and the first to implement it outside of Heidelberg in 1977. The International Society for Plastination was founded in 1986 and the inaugural issue of Journal of the International Society of Plastination was published in 1987. In 1990, the process extended the frontier of biological specimen preservation with the plastination of a whole human body. The first public exhibition of whole human body plastinates and the juxtaposition of healthy and diseased organs was shown in Tokyo, Japan in 1995. Currently, plastination is performed in over 40 countries at 400 institutes of Anatomy, Pathology, Biology and Zoology. Since 2003, public exhibitions of human plastinates have been presented worldwide, and several entities have emerged to provide polymers and equipment for plastination.

Principals of silicone (S10) plastination. ***De Jong KH***. *Department of Anatomy & Embryology, Academic Medical Centre, University of Amsterdam, Netherlands.*

Plastination is defined as the replacement of tissue water and fat with a curable polymer, either silicone, polyester or epoxy. As all polymers are not soluble in water, tissue water has to be replaced with a volatile intermediate solvent, which is subsequently replaced with the polymer of choice. Replacement of water with the intermediate solvent, (dehydration) preferably done with acetone, is performed by placing the specimen in subsequent baths of 100% acetone until a grade of dehydration of >98.5% is reached. After sufficient dehydration the specimen is placed in a receptacle filled with silicone monomer mixed with a combination of catalyst and cross-linker, which is called the impregnation- or reaction mixture. As acetone and reaction mixture are soluble in each other, acetone will diffuse in the reaction mixture. The receptacle with the specimen and reaction mixture is placed in a vacuum-chamber and the pressure is slowly decreased (vacuum is increased). This will cause that the acetone, dissolved in the reaction mixture will evaporate, and new acetone will dissolve from the specimen in the reaction mixture, resulting in a negative pressure in the specimen. This negative pressure will "drag" the silicone molecules into the specimen. By gradually increasing the vacuum slowly all the acetone will be replaced by silicone. This part of the Plastination-process is called forced impregnation When the forced impregnation is complete, the specimen is brought to atmospheric pressure, taken out the reaction mixture and left to drain. When the excess silicone is drained off, the specimen is exposed to a gaseous cross-linking agent, which will form a 3D meshwork of the silicone monomer molecules inside the specimen, first at the surface, making it safe to handle, later also deeper inside the specimen. This process is called curing. Processing time is dependent on the size and tissue of the specimen, and varies from 6 weeks to several months.

Room-temperature impregnation with cold-temperature silicone products. ***Henry RW***. *University of Tennessee, Department of Comparative Medicine, Knoxville, TN, USA.*

Background: The Biodur S10/German/cold-temperature plastination process and products have been used nearly thirty years and have become the gold standard for tissue preservation. Like any good product, alternatives, whether good or bad, are often developed. Such is the case for silicone plastination, both alternative products and techniques are now available. A true room-temperature impregnation process has been developed. Most silicone products for plastination produced today likely could be used in either methodology(cold or room temperature), therefore little is truly unique concerning these "new" products and methodologies. Methods: The main difference of the Room-temperature/Dow™/Corcoran methodology is in the sequence in which basic plastination chemicals are combined and used. The impregnation-mixture is polymer plus cross-linker (instead of polymer plus catalyst and chain extender). This polymer/cross-linker combination is stable at room temperature, while the

polymer/catalyst combination is reactive and is usually kept in the cold at all times. Results: The Biodur chemicals have been used successfully with this room-temperature methodology. Similar polymer/ additive ratios of chemicals were used. Specimens plastinated by this methodology are of similar quality to those produced by the currently recommended products available for room-temperature impregnation. Conclusion: Silicone polymer and additives, designed for cold-temperature impregnation, can be used for room temperature impregnation. However, specimens plastinated by the room-temperature impregnation technique, regardless of products used, are not equal to the gold standard quality of specimens produced by the cold temperature technique.

Degreasing by benzene in silicon10 technique. ***Basset Aly AE, A Abdel Aziz, S Abdel Aziz, H Nosiur, M Konsowa, KZ Soliman***. *Plastination Laboratory, Faculty of Veterinary Medicine, Zagazig University Zagazig, Egypt.*

Background: The aim of this work is to reduce the costs of plastination in Zagazig Plastination Laboratory. During our preparation of plastinated specimens by S10 technique for teaching of Veterinary Anatomy (subject arthrology), we had a stifle joint of a horse contained large amount of adipose tissue. Degreasing process would require a huge amount of acetone.Benzine was used as a degreasing agent, which was 20 times cheaper than acetone in Egypt and almost same results as acetone. Material and Method: After routine fixation by formalin 10% and prosection, the stifle joint was immersed in Benzin (commercial 80) for 3 weeks, changing the benzene every week at room temperature. The fat was degreased, then the specimen was washed in running water for one day. Dehydration: Routine dehydration in cold acetone. Forced Impregnation: Routine forced impregnation (Biodur® S10 &S3). Curing: Routine gas curing (Biodur® S 6). Results: The results were quit good but slight yellow coloration from benzene was observed. Conclusion: The use of benzene (commercial 80) reduced the costs of plastination and allowed our plastination laboratory to produce more joints specimens for teaching of Veterinary Anatomy.

A low-temperature dehydration/ room-temperature impregnation protocol for brain tissue using Biodur S10/S3. ***Adds PJ***. *Division of Basic Medical Sciences (Anatomy), St George's, University of London.*

Background: The standard method for plastination with Biodur S10/S3 silicone involves low-temperature dehydration in a volatile intermediary solvent (acetone or methylene chloride) followed by forced impregnation under vacuum at -15°. However, some institutions have been reluctant to install low-temperature impregnation equipment because of health and safety concerns. A room temperature set-up has the advantages of low cost and simplicity of set-up, and avoids the potential safety hazards associated with low-temperature impregnation. At its best, this method can yield specimens equal to those produced by low-temperature impregnation, but it is not suitable for brain tissue because of the degree of shrinkage. We have trialed a low-temperature dehydration/ room-temperature impregnation method for plastination of brain slices. Method: Formalin-fixed brains were cut into transverse or coronal 1.5cm slices, washed first in 50% ethanol then in water, pre-chilled to 4° C then dehydrated in sealed containers of acetone at -30° C weekly for 3 weeks. The brain slices were then placed in Biodur S10/S3 100:1 and allowed to equilibrate overnight to room temperature. The specimens were then impregnated, drained and cured at room temperature. Measurements of the length and width of each slice were taken after slicing and post-impregnation. Results: The quality of the plastinated brain slices was good, with clear definition of white and grey matter. Shrinkage was less than 5%, and the value of the slices as teaching aids was not impaired. Conclusion: Room temperature plastination is an attractive option for reasons of speed, low setting-up costs and avoiding health and safety hazards, and can give comparable results to the low-temperature process for most tissues except CNS. By combining low-temperature dehydration in sealed containers with room-temperature impregnation, brain slices can be plastinated at room temperature with minimal shrinkage.

Effects of cold and room temperature impregnation on morphological features of the heart during plastination. ***Dhingra R, DN Bhardwaj, K Ilavenil, R Kumar***. *Department of Anatomy, All India Institute of Medical Sciences, , Ansari Nagar, New Delhi, India.*

Background: Plastination has evolved as a new tool for preservation of specimens and can be used as a valuable adjunct for teaching medical students as it offers many advantages over the traditional formalin fixed specimens. The process of plastination involves fixation, dehydration, impregnation and curing. The impregnation is done under vacuum and is the central step of plastination. It may take 2 to 5 weeks to carry out the forced impregnation depending on the temperature. In the present study we aimed to compare the process of impregnation at -20°C with that of at room temperature(25-30°C) and see if room temperature impregnation could minimize the time

spent and financial burden of deep freezers. Material and methods: A total of 20 hearts obtained from autopsy cases being done at department of Forensic medicine, AIIMS were used for the study. Each heart was subjected to dilatation, fixation, dehydration, impregnation and curing. The hearts were divided into two groups (A and B) and each comprised of 10 hearts. All the steps of the procedure were same in the two groups except the impregnation under vacuum. The impregnation was carried out at room temperature (25-30°C) for group A hearts and at cold temperature (-20°C) for group B hearts. The procedure of pre-curing and curing was same for both the groups. Results: The time taken for forced impregnation for group A hearts [room temperature (25-30°C)] was 12 -14 days and was completed at 75-100 mm Hg of pressure, whereas in group B the cold impregnation was complete at 5-10 mm Hg and the time taken was 30-37 days. The morphological features were evaluated on the basis of shrinkage percentage, color, dilatation, flexibility and preservation of external and internal features of heart. The mean shrinkage percentage of group A hearts (room temperature impregnation) was 4.54+ 1.76 and for group B hearts (impregnation at -20°C), it was 4.97+2.67. The difference in shrinkage percentage was statistically insignificant. The other parameters like color, dilatation, flexibility and morphological features were well preserved in both the groups. Conclusion: The rate of impregnation was faster at room temperature however this did not distort the anatomical features of hearts and saved the cost of freezers and electricity. The impregnation done at room temperature has a disadvantage of reduction in the life of the polymer mixture which can be partially overcome by storing the polymer mixture in a freezer in between impregnation cycles.

The plastination Biodur S10 technique applied in teaching the male genital organs in veterinary anatomy. ***Diz A, J García-Monterde, E Agüera, J Vivo, JL Morales, JM Navas-Lloret***. *Department of Comparative Anatomy and Pathology, Faculty of Veterinary Sciences, University of Córdoba, Spain.*

Background: In the teaching program of the Veterinary School of Córdoba, the Gross Anatomy is included in two of its subjects, Embriology and Sistemic Anatomy -1st academic year- and Neuroanatomy and Topographic Anatomy -2nd academic year-. In the lab sessions of the first one, canine dissected specimens are mainly used. In the program of the second academic year subject a part is extensively devoted to the learning of regional and topographical anatomy by species (carnivores, horse, ruminants, pig and birds). To help to a better understanding fresh, formalin-fixed and plastinated specimens are used in the dissection room. In the above two mentioned subjects the male genital organs must be thoroughly analyzed. An Veterinary Anatomy Museum is regularly used by students to complete the objectives of theoretical and practical lectures. The aim of the present study was to describe the advantages of using plastinated specimens compared to fixed and fresh pieces in the teaching of the male genital organs in Veterinary Anatomy Materials and methods: During necropsy male genital organs of domestic animals whose death was not due to infectious cause were removed. After that, they were cleaned, fixed with formalin (5-10%) and thoroughly dissected to make clear the structures of anatomical interest. Then, the specimens were plastinated by using the Biodur S-10 Technique. Finally, part of them were destined for its study in the dissection room and the rest were located in the Veterinary Anatomy Museum to be freely used by the students. Results: Plastinated specimens of male genital organs were well accepted by the students in the dissection room. The main advantages are that they are dry without toxicity and odor and a special equipment, like gas extractor, is not necessary, when comparing to the traditional fresh and fixed pieces. Those destined to the museum are exhibited in glass cases at free disposal of the students. Conclusion: The Biodur S-10 technique of plastination is useful in the understanding and learning the male genital organs in Veterinary Anatomy. Compared to fresh and fixed specimens, plastinated pieces have no toxicity and are durable, which allow not only their use in the dissection room but they may also be exhibited and studied in the Anatomy museums.

Use of first whole body plastination by S10 technique adjunct to dissection in Iran. ***Asadi, MH, H Bahadoran, GR Hassanzadeh***. *Department of Anatomy Baqiyatallah University of Medical Sciences, Tehran, Iran.*

Background: Despite the proliferation of medical schools in Iran the scarcity of cadavers for anatomic dissection continues to be aggravating problems. For this reason at Baqiyatallah University of Medical Sciences, a whole body plastination has become an essential component of medical anatomy education for past two years. The aim of this study has been to provide suitable specimen that reflect the essential concepts in anatomy in order to promote students learning and progress. Material and Methods: The cadaver was fixed by formalin. After fixation, teaching protocols were prepared for each region of anatomy. Then this region were carefully dissected and prepared

for plastination. Following dissection specimen were dehydrated by various grade of cold acetone. Forced impregnation was done by S10 and S3 mixture at –20°C. Then the specimen was kept at room temperature for 5 weeks to drain the excess polymer. In final stage, the specimen was subjected to gas curing for ten days at room temperature. Results: Use of whole body plastination adjunct to dissection in anatomy laboratory enable us to present a complete visual and physical guide to the human body in a revolutionary way, which making anatomy more interesting, easier to learn and more relevant to the students future career objectives. Also it was very helpful in learning the spatial relationships of important anatomical structures. Conclusion: Use of whole body plastination, adjunct to dissection are planned for a wider use in future education program to assist other university and students in Iran.

Creative dissection for plastination. ***Von Hagens G***. *Gubener Plastinate GmbH, Guben, Germany.*

Compared with other dry preservation methods such as freeze drying or paraffinization, plastination leads to specimens with highest mechanical strength. This is due to the high mechanical properties of reactive polymers such as polyester or epoxy resin which are used for the manufacture of plastinated body slices and for the manufacture of dissected silicone rubber specimens up to the size of whole human bodies or even large animals such as a horse and a giraffe. Due to their hardness plastinates can be regarded as combined muscle-organ-bone skeletons. Soft tissue such as muscles can take over the holding function and keep organs or even joints in place. Stainless steel bars, inserted into the long bones and bridging joints can further increase the stability of plastinates. This stability of plastinates makes new kinds of dissections possible not seen before the advent of plastination. As for whole human body specimens the following new specimens became possible: (1) Specimens with opened body doors, (2) Display of organs and organ systems side by side such as a man with his skin or skeleton beside his own muscles in identical poses, (3) Fragmented specimens where organs, muscles or bones are shifted apart from one another, creating visible space in between. Especially the complex anatomical features of joints and of the human head could be dissected in new and favorable ways. Twenty of those new dissections will be demonstrated and their advantages discussed. As examples; the demonstration of the rotary cuff of the shoulder joint with a spilt humeral head and exposition of the glenoid fossa, a human head opened in door-like dissected tissue layers, and a layer dissection of the gluteal region. The dissected specimens can be evaluated during the visit to the Plastinarium in Guben.

Frankincense plastination after honey fixation. ***Elhag AH.; AM Al-Wahaibi***. *Sultan Qaboos University, Alkhodh, Sultanate of Oman.*

Background: In the scientific community's urge to find safer scientific techniques, utilizing natural recourses around us might proof to be efficient in providing safety, less cost, and quality. Honey was used as a fixative to replace the widely used Formalin. Reported formalin hazards increased the awareness to limit its use or even to replace it. The choice of honey, as a fixative, was supported by our earlier findings in using it as a histological fixative. The use of Frankincense or as better known locally Luban, as an impregnation and embedding medium, was supported by the fact that it contains 60-70% resins according to literature, this might qualify it to for purposes mentioned above. Material and Methods: Four "Goat" kidneys and three hearts were collected, rinsed thoroughly in running tap water. Two of the kidneys were bisected; the heart chambers were cut open to facilitate fixative penetration. Specimens were fixed in 20% honey solution, washed in running tap water, dehydrated in acetone, and finally impregnated with Frankincense solution under vacuum. Control specimens were processed using the standard formalin fixation and Silicon resin impregnation (S10). Result: Formalin fixed and silicon impregnated kidney (control) exhibited small flexible with natural color. Formalin fixed and Frankincense impregnated kidney (specimen 2) is not flexible, dry in texture and darker in color compared to the control. Honey fixed and Silicon impregnated kidney (specimen 3) is more flexible, darker in color and shrunken in size compared to the control. Honey fixed and Frankincense impregnated hearts (specimen 4, 5 & 6) were more flexible (initially) darker in color compared to the standard Silicon impregnated heart which is less flexible with natural color. Conclusion: Both methods; honey fixation and Frankincense impregnation experimented in this study were found to be; economic, time saving, safer on health and environment and produced specimens of good quality. All results are true for the tissue types used in this study. The project is to be continued for further refinement of the method.

Comparison of gross morphological features in freshly and old embalmed human hearts using plastination. ***Kumar R, K Ilavenil, R Dhingra***. *Department of Anatomy, All India Institute of Medical Sciences, Ansari Nagar, New Delhi, India.*

Plastination is a technique of tissue preservation in which water and lipids are replaced by polymers which are subsequently hardened. The plastinated specimen becomes dry, odorless and durable. Plastination of various organs is being tried world over using old embalmed human organs, However for the lifelike appearance and better preservation, we have tried to plastinate freshly fixed(obtained during autopsy) organ the human heart and compared its morphological features with that of old embalmed heart. A total of twenty freshly fixed hearts and six old embalmed hearts were taken for the study. Each was subjected to the standard technique of plastination using S-10 method. The process of plastination of heart involved dilatation of heart, fixation with 5%formalin, dehydration by giving 4 changes with cold acetone (-20˚C), impregnation in S3, S10 mixture and gas curing at room temperature. Old hearts, since they were already formalin fixed could not be dilated as the fresh fixed ones. But their morphological details were preserved. In the freshly fixed hearts the morphological features such as color dilatation flexibility were better visualized. The internal features such as AV, pulmonary and aortic valves were very clearly visible. They did not collapse and shrink as compared to the old embalmed hearts. Also the handling and aesthetics were better in these hearts. They preserved their lifelike appearance as compared to old embalmed hearts which looked darker due to long preservation and were relatively non-flexible. Thus the features were more lifelike, better preserved and clearly visible in freshly fixed hearts as compared to old embalmed hearts.

Shrinkage of renal tissue after impregnation via the cold Biodur plastination technique. ***Pereira-Sampaio MA[1,2], FJB Sampaio[1], RW Henry[3]***. *[1]Urogenital Research Unit/UERJ, Rio de Janeiro, Brazil, [2]Morphology/UFF, Niterói, Brazil, [3]Comparative Medicine/UT, Knoxville, TN, USA.*

Background: Thorough dehydration is a key for good plastination and invariably it leads to shrinkage. Shrinkage during plastination has been studied minimally. This study quantifies the shrinkage for each of these activities. Methods: Total tissue shrinkage was studied on ten pig kidneys including regional shrinkage of the kidney (cortex, medulla, sinus) and at which stages of the process (dehydration, impregnation, curing) shrinkage occurred. Kidneys were fixed by perfusion of 10% formalin solution via the renal artery. Next, the vessels and ureter were filled with colored E RTV Silicone. The fixed, injected kidneys were cut into one centimeter transverse slices. The classic cold von Hagens' method was used to plastinate two slices of each kidney. The slices were dehydrated via freeze substitution (-20oC) and impregnated with silicone at -15oC. At the end of each stage of the plastination process, slices were photographed using the same focal length with a digital camera. Slice surface area was determined by a point-counting planimetry method. Results: Total shrinkage of kidney area was 10.2 % post-dehydration and 10.1% post-impregnation. After completion of plastination, total area of kidney slice shrinkage was 19.7%. Cortical area shrunk 12.8% after dehydration and 13.2% after impregnation. After plastination, cortical area had shrunk 24.3%. No significant shrinkage occurred in the medulla and sinus. Shrinkage has been reported with dehydration. Our results demonstrate that kidney shrinkage during impregnation is as intense as during dehydration. Significant shrinkage occurred in the renal cortex but not in the medulla and sinus. Conclusion: This demonstrates that different tissue types, even in the same specimen, may have different rates of shrinkage during dehydration and impregnation.

Renal tissue shrinkage: comparison of 3 classic dehydrants when used with the cold or room temperature Biodur plastination technique. ***Pereira-Sampaio MA[1,2], FJB Sampaio[1], RW Henry[3]***. *[1]Urogenital Research Unit/UERJ, Rio de Janeiro, Brazil, [2]Morphology/UFF, Niterói, Brazil, [3]Comparative Medicine/UT, Knoxville, TN, USA.*

Background: Usually an acceptable percent shrinkage occurs in plastination. This study examines the effects of alcohol and acetone dehydration on shrinkage of the kidney. Methods: Renal vessels and collecting system of 25 fixed porcine kidneys were filled with ERTV silicone and 5 kidneys received no ERTV. All kidneys were sliced transversely at 1 cm intervals. ERTV slices were divided into 4 groups for dehydration using methanol, 2-propanol, ethanol, and ethanol followed by methylene chloride and then subdivided into 2 more groups for impregnation (via cold and room temperature). Non-ERTV slices were divided into 3 random groups (5 slices each) and dehydrated using graded series of either ethanol, ethanol with a final methylene chloride bath, or acetone and impregnated in cold temperature. All slices were photographed after fixation, dehydration, impregnation and curing. A grid was placed over each picture to determine slice area by the counting point planimetry method. Renal tissue shrinkage was calculated after each plastination step, as well as, shrinkage for the entire kidney and each renal part (cortex, medulla and sinus). Results: All kidneys shrank (6.1% to 62.5%). Shrinkage occurred during each plastination step: dehydration (4.2% to 11.7%),

impregnation (7.2% to 34.5%) and curing (1.7% to 4.3%). However, shrinkage was significant only during impregnation. The renal cortex shrank the most (6.6% to 83.3%). Shrinkage was minimal and not significant in 5 groups: Methanol ERTV (room impregnation), Propanol ERTV (room and cold impregnation) and Acetone without ERTV (room and cold impregnation). With Ethanol ERTV there was significant shrinkage after cold impregnation in the cortex ($p \leq 0.01$) (mean 65.3%), medulla ($p \leq 0.05$) (mean 57.8%) and entire kidney ($p \leq 0.01$) (mean 54.7%). Nevertheless, there was no significant shrinkage with room temperature impregnation, even for this group. Significant cortical shrinkage (mean 20.9%) and of entire kidney (mean 17.9%) occurred during impregnation ($p \leq 0.05$) in Ethanol without ERTV. After impregnation Methylene Chloride without ERTV had significant shrinkage ($p \leq 0.05$) in the cortex (mean 26.2%) and the entire kidney (mean 26.4%). Concerning room temperature vs. cold impregnation, there was no significant shrinkage in both room temperature and cold impregnation with Propanol ERTV. There was no significant shrinkage in Methanol ERTV and Methylene Chloride ERTV room temperature. However, both Methanol ERTV and Methylene Chloride ERTV cold temperature had shrinkage over the entire process. Conclusion: Shrinkage in renal tissue was the greatest in the cortex and during impregnation. For renal tissue, if measurements are to be carried out, propanol dehydration was the best as there was no significant shrinkage, while ethanol dehydration had the most shrinkage. Shrinkage was greater with cold impregnation. This is likely a reflection of the direct effect of cold on the solvent boiling point.

Principles of epoxy plastination technique (E12). ***Sora M-C***. *Center for Anatomy and Cell Biology, Medical University of Vienna, Austria.*

Background: The E12 plastination process is a well-established preservation technique used for demonstration in teaching and also in research (von Hagens et al., 1987). Material and 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 are 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% (AC1), by using technical quality acetone. The final concentration of the dehydration bath was 99% (AC2). When dehydration is finished the freezer is disconnected. The temperature increases and after one day room temperature (+15°C) is reached. Now the acetone is changed with room temperature methylene-chloride (MCL) for degreasing. Degreasing is finished after 7 days. Impregnation: Impregnation is performed at +5°C using the following epoxy (E12) mixture: E12/E1/AE10 (95:26:10 pbw) (von Hagens, 1985). The slices were submerged in the E12 mixture and placed in a vacuum chamber, directly out of the methylene chloride bath. Pressure is continuously reduced over the next two days down to 2 mm Hg. Temperature is kept under surveillance in order to avoid E12 crystal formation which would take place if temperature decreases under 0°C. Casting and Curing: The slices are casted between two sheets of tempered glass and a flexible gasket is used as a spacer (4 mm). The following E12 mixture was used for casting: E12/E1/AT30 (95:26:5). The slices are placed between glass plates, sealed and the flat chambers were filled with casting mixture. Then they are placed for one hour in a vacuum chamber at 3 mmHg to remove small air bubbles present in the resin. Large bubbles are removed afterwards manually. After bubble removal, the flat chambers are placed horizontally inclined at 15° and left like that for the next one day. The polymer gets more viscous and sticky and after one more day the flat chambers containing the slices are placed in an oven at 45°C for 4 days. Results: The transparency and color of the slices are perfect and shrinkage is not evident. The finished E12 slices are semi-transparent, easy to orientate and offered a lot of anatomical details down to the submacroscopical level. The transparent loose areolar and adipose tissues contrasted perfectly with the muscle tissues and all epithelial parenchyma. Conclusion: The E12 technique was and still is the elected method for producing transparent body slices. Transparent body or organ slices are used for teaching and research purposes, because they allow studying the topography of all body structures in a non-collapsed and non-dislocated state. In addition, the specimens are useful in advance training programs (CT and MRT).

Sheet plastination with the E13 technique. ***Von Hagens G***. *Gubener Plastinate GmbH, Guben, Germany.*

Plastination of transparent body slices has been accepted as providing superior teaching specimens. The newly introduced E 13-technique shall serve as an alternative to the E 12-standard technique as described in the Heidelberg Plastination Folder 1985. The strengths and the weaknesses of both techniques will be discussed. The following table shall serve as an

overview and will be discussed during the presentation. Sample slices will illustrate the results.
Technique E12-technique E13-technique
Manufacturing time 2 – 3 days 2 – 3 weeks
Long time yellowing yes no
Separation foil polyester foil silicone foil
Separation from glass plates with release agent no
Number of components two
Transparency of fat high reduced
Property of hardener ammonia smell to be heated up

Advanced exploration of anatomical concepts using E12 sheet plastination. ***Cook PR***. *Department of Anatomy with Radiology, University of Auckland, Auckland, New Zealand.*

Background: The E12 plastination technique is a unique means of achieving precise human sectional anatomical specimens that correlate well with radiographic imaging techniques such as magnetic resonance imaging and computed tomography. E12 plastinated sections are typically 2.5mm thick, smooth, semi-translucent, durable and offer a very high degree of anatomical detail not usually seen in traditional cadaveric wet specimens or in other plastination techniques, and can often surpass the detail available with current radiographic imaging techniques. Methods: The standard E12 process of sawing, dehydration by freeze substitution, degreasing, forced impregnation, casting in flat chambers and heat curing is followed according to established protocols using Biodur epoxy polymer methodology. Results: The unique properties of the E12 process offer an exceptionally vivid survey of the human body in any given plane that in addition to presenting the structural layout in situ also allows significant highly detailed views of any given region right down to the sub-macroscopic level. Standard microscopic teaching and research glass slides providing detail of a specific structure within predetermined parameters are often dictated by the physical limitations of the size of the actual microscope slide itself. E12 sections provide a high degree of detailed anatomical orientation whilst most importantly retaining the in situ structural integrity of the entire region in a complete and uninterrupted state. Conclusions: The detail within E12 sections may be enlarged considerably under high magnification television equipment and even under light microscopy and have proven vital in linking several disciplines namely gross anatomy, pathological anatomy, radiology and microscopic anatomy all from the same specimen.

Excellent brain and tissue slices in one week using P40. ***Henry RW***. *University of Tennessee, Department of Comparative Medicine, Knoxville, TN, USA.*

Background: The Biodur® P40 plastination process and products have been used for a decade and a half and have become the standard for convenient preservation of tissue slices. This product was developed to be a less complex technique for production of brain slices. Vivid sectional anatomy slices, from various regions, are produced and demonstrated using the Biodur® P40 technique. Methods: Two to three millimeter slices of brain or body slices are produced on a band saw from frozen tissue (at least -40°C) is recommended. Slices are cleaned of saw dust and submerged in cold acetone (-25°C) and thoroughly dehydrated. Dehydrated slices are impregnated at room temperature or in the cold room in an immersion bath of P40 or P40 plus an activator. After impregnation overnight, the slices may be stored or removed and placed in glass curing chambers. The slices are cured using UV-light from bulbs or in the shadow of the sun. After curing the slices are removed from the glass chambers, wrapped in foil, and the excess perimeter of polyester is sawn off. Results: High quality polyester sheets with the specimen incorporated within are produced. Anatomical detail is superb. Discussion: Slices from any region of the body may be produced and are excellent educational aids. There use as aids for interpreting images produced using modern diagnostic imaging techniques is unparalleled. Impregnation resin without additives may be reused thus reducing the cost per unit. Natural UV-light may be used as the catalyst. While the Polyester - P35 technique remains the gold standard for brain slices and the epoxy - E12 technique remains such for body slices; both techniques require voluminous effort (time, hands and materials) to prepare slices using these techniques. The major benefit of the P40 technique is the comparative minimal effort needed to produce high quality sections.

Sheet plastination of anatomical objects preserving the natural shape. ***Starchik D, F Kucher***. *International Morphological Centre, St. Petersburg, Russia.*

Background: The sheet plastination of thin slices with epoxy resin allows to demonstrate all the anatomical structures which are in area of section only. Our topic is to demonstrate the topographic spatial anatomy of complex organs using series of slices. The distinctive features of our technique are the opportunity to preserve natural form of a whole organ or part of the body and determine the level of the section. Methods: The process of sheet plastination was carried out as follows: the 6 longitudinal slices (10 to 30 mm thickness) of human foot were made using a high-speed band saw

with the thinnest blade. Then the slices were dehydrated and degreased in acetone. The impregnation procedure was divided into two steps. The first step provides the complete substitution for an acetone in tissue by resin impregnation-mix. The slices were put into epoxy resin with hardener and impregnated as usual. After extraction from impregnation bath they were put between two organic glass plates for two weeks till the resin becomes firm. Then they were polished with the purpose to achieve smooth and congruous surfaces. The skin on each slice was covered with paraffin. The second impregnation with reaction-mixture allows to achieve complete removing of air bubbles and to produce flat and smooth surfaces. On the closing step paraffin was removed from hardened slices by putting them in warm water with final cleaning of surfaces with solvent. Results: All the developed slices had enough clarity to be studied in passing and reflected light. Because of smooth and congruous surfaces of the slices the model of the foot can be easily reconstructed. Preliminary injection of colored-silicone into the arteries makes demonstrative properties of the slices much better. Conclusions: The plastinated slices allowed getting an impression not only about geometry of studied organ but to determine the level of section exactly. This method is useful for creating wedge-shaped slices in order to study topographic anatomy of anatomical structures in any part of studied organ. Besides, this way minimizes amount of wasted tissue and can be considered as practicable.

Thin flexible sheet plastination of human brain. ***Hajian M, A Rabiei, A Fatollahpour, E Esfandiary***. *Isfahan University of Medical Sciences, Isfahan, Iran.*

Plastination is a modern technique that stops decay and deterioration of natural tissues. This new preserving technique includes substituting water and fat with synthetic polymers, such as silicon resins, epoxy resins, acrylic resins and unsaturated polyester resins. In this work, a human brain was fixed in 10% formalin solution for about 1 month. The specimen was then, cut into 1mm thick sections by sausage cutter machine. The sections were dehydrated by cold acetone for a few days and were forced impregnated by P 87, our new soft and flexible polymer, which recently was made in our department.

Enabling sheet plastination with minimum effort and equipment. ***Von Horst C[1], RW Henry[2]***. *[1]HC Biovision, Mainburg, Germany, [2]Department of Comparative Medicine, College of Veterinary Medicine, The University of Tennessee, Knoxville, USA.*

Background: Medical, veterinary and biological institutions, museums and practitioners from various fields worldwide are using sheet plastination specimens. Nevertheless only a few places are able to perform sheet plastination themselves. This is mainly due to the large amount of equipment and experience needed in comparison to silicon plastination and other preparation methods. The goal of our study was to enable as many institutions as possible to prepare their own sheet plastinates with minimal effort and equipment and still receive the highest quality specimens. Method: We used the Tissue Tracing plastination Technique (TTT) invented by Dr. von Horst. Compared to a regular series of parallel sheets of constant thickness, the TTT method allows one to follow anatomical structures within one sheet and to adjust the thickness in different regions of the same specimen for enhanced visual detail and contrast. Apart from these advantages, we chose the TTT method because it allows a division of work between institutions and a professional plastination service provider. Results: The main key to simplifying the process was dividing the work into two parts: 1. The preparation of pre-plastinates by the institutions themselves, 2. Tissue tracing and embedding (with or without acrylic layers) by HC Biovision. This reduces the equipment needed to the following:

- household freezer
- manual bone saw
- buckets of formalin solution and Acetone
- epoxy or polyester plastination resin
- a simple vacuum setup (exsiccator + vacuum pump)

The different steps are:

- deep freezing of the specimen,
- cutting slices of ca. 20mm with a manual bone saw,
- immersion of the slices in 4% formaldehyde solution,
- immersion of the slices in acetone at room temperature,
- changing the acetone 5 times in a 1:10 relation (specimen : acetone),
- vacuum impregnation in an exsiccator,
- curing at room temperature,
- sending the pre-plastinates to HC Biovision for Tissue Tracing and embedding.

Discussion: With the new approach laboratories without special sheet plastination equipment and experience can avoid the most critical steps in sheet plastination by preparing pre-plastinates for further processing by HC Biovision. Most advantages arise from the thickness of the pre-plastinates: an electric bone saw with cooled guide stop is not needed, saw dust does not have to be removed, handling of specimens at any stage is very easy. Critical steps like putting specimens in a perfect shape without bubbles and inclusions and giving them a final polish are taken over by experienced specialists.

Finally the TTT method achieves excellent anatomical visualization by adjusting the thickness of the various tissues for optimal clarity and following structures through the tissue.

Root canal obturation and alveolar ridge augmentation in dental surgery evaluated by sheet plastination. ***Weiglein AH[1], B Weninger[1], L Kqiku[2]***. *[1]Institute of Anatomy, [2]Dental Clinic, Medical University, Graz, Austria.*

During the last four years we have established a dental research laboratory based on polyester plastination and plastination micromorphology. The central equipment for this program is the P35 plastination lab plus the ultra thin slicing and grinding system comprising a diamond band saw (Exact 310 CP) and a diamond grinding system (Exact 420 CL) which allow 1) to produce thin sections (500-100 micron) of P35 impregnated specimens at the exact level of interest and 2) to produce ultrathin sections (100-10 micron) for histological evaluation. The thin sections at a predefined level have been used to study the quality of different root canal obturation methods and to study a new methodology for obturation after root tip extraction. The ultrathin histology is recently used for the study of bone-implant-interfaces and bone remodeling in dental implantology. The later allowed us to deal with large serial implant specimens, which is not possible with the standard methacrylat protocol. Moreover, osseo-integration was evaluated by plastination histology and Micro- CT to study the accuracy and comparability of both methods. Parallel to the bone remodeling study we also studied the regeneration of the inferior alveolar nerve after injury during implant placement. In all studies the results are excellent and permanent thin sections of the desired region, which allow studying the quality of root canal obturation methods, of implant-osseointegration and of nerve regeneration in series. Thus, the study proves that polyester plastination is an excellent replacement for standard histology embedding methods (e.g.: methacrylat) with the special advantage of being much less expensive.

Thin slice plastiantion and 3D reconstruction. ***Sora M-C***. *Center for Anatomy and Cell Biology, Medical University of Vienna, Austria.*

Background: The E12 method of plastination is usually used to create 2.5 - 5 mm transparent slices. If thinner slices, 0.5 - 1.5 mm, are desired, it is necessary to use the thin-slice plastination method. By using this method the specimen must be first plastinated as a block and then cut into thinner slices. The impregnation temperature is the key element to obtain a proper impregnation of the desired tissue block and contrary to all other plastination methods high temperature is used. The main goal of this paper is to describe the use of high temperature for processing 1 mm epoxy plastinated slices. Only by using high temperature is the polymer thin enough to penetrate into the middle of the processed specimen. Materials and Methods: One male unfixed human cadaver ankle was used for this study. The distal third of a limb was cut and the foot positioned in a 90° dorsal flexion. A tissue block containing the ankle was cut starting 40 mm distally to the tip of the lateral malleolus and finishing 50 mm proximal. The tissue block was dehydrated, degreased and finally impregnated with aresine mixture E12/ E6/ E600. Using a band saw, Exact 310 CP, 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 and the model was qualitatively checked for surface discontinuities. Results: An E12 block was produced that was hard and transparent. Thin, <1 mm slices produced from this block were transparent and hard with good optical qualities. The finished E12 slices provided anatomic detail to the microscopic level. Conclusion: Thin slices <1 mm are essential if the histology is to be studied on plastinated slices or if 3D reconstruction is desired. These thin slices can only be cut from a solid E12 block. Therefore, knowledge of controlling temperature and percent of accelerator in the thin-plastination method is essential. Histological examination can be performed up to a magnification of 40X. The major advantage of this method is that the structures remain intact and the decalcifying of bony tissue is not necessary.

Morphometry of fish muscle fibers in thin epoxy sections: comparison of two processing protocols. ***López-Albors O[1], MD Ayala[1], F Asensio[2], E Abellán[3], J Albarracín[1], J Arredondo[4], R Latorre[1]***. *[1]Veterinary Anatomy and [2]Microscopy Service, University of Murcia. Spain. [3]Spanish Oceanographic Institute, [4]Autonomous Univ. of the State of Mexico, Mexico.*

Background: In commercial fish knowledge of the size of muscle fibers is important to assess the texture of the flesh. The average size of muscle fibers can be estimated by measurement of the cross-sectional area or diameter of a representative number of muscle fibers. When traditional histological protocols are used it is almost impossible to obtain a complete cross-section of the fillet which guarantees that the fibers used for morphometry are really representative. Plastination can

overtake this limitation since the whole cross-section of the fillet can be embedded in an epoxy resin mixture. The obtained block is then cut in thin slices which, after polishing, can be viewed by light microscopy. However, since the plastination process may affect the size of muscle fibres, a comparison between plastinated and non-plastianted sections should be done before validating plastination as an appropriate tool for muscle morphometry. We have investigated this purpose by using either the traditional methodology of muscle tissue processing (cryopreservation) or formaline fixation, both before epoxy impregnation. Methods: Two commercial size sea bass (Dicentrarchus labrax, L.) were used in this study. Two consecutive crosssections (1cm thickness) of the trunk musculature were done in each specimen. Both cranial sections were trimmed in 8 equal blocks of (1x1x1 cm), then frozen in isopentane cooled over liquid nitrogen and finally sectioned in cryostat. The caudal section of one specimen was frozen in cooled isopentane (without trimming) and the other fixed in 10% formalin. Both caudal sections were then plastinated (E12-E6-E600, Biodur®) and cut with a contact point diamond band saw. After polishing, the final thickness of the slices was 80-90 µm. The area and diameter of 800 muscle fibres, equally distributed over the trunk cross-section were recorded in both the cranial and caudal sections. A comparison of the size of the fibers was done for a statistical significance of 95%. Results: The caudal section which, before plastination, had been previously frozen in cooled isopentane was not useful for morphometry of muscle fibers. The dehydration process had altered the structure of muscle fibers and their limits were not clearly observed. Contrarily, in the formalin fixed section, despite of evident shrinkage, the structure of muscle fibers was preserved. The comparison of the size of muscle fibers in this plastinated section and the corresponding cranial section of the same specimen demonstrated that shrinkage was 9,77% for the area and 8,5% for the diameter of muscle fibers. Conclusion: Unfixed, snap-frozen fish muscle was not useful for morphometry purposes after epoxy plastination. Formalin fixation preserves the structure of muscle fibers, however excessive shrinkage limits the use of thin epoxy plastinated slices for fish muscle morphometry.

A new perspective from sheet plastination examination: the longitudinal coat and anal glands. ***Zhang J-J[1], H Han[1], M-C Sora[2], M Zhang[3]***. *[1]Anhui Medical University, Hefei, China, [2]Medical University of Vienna, Vienna, Austria, [3]University of Otago, Dunedin, New Zealand.*

Background: Current understanding of the aetiology of idiopathic anorectal sepsis is based on the concept of infection of the anal glands. The key to this theory is the microanatomy of the anal glands (AGs) and their relation to the surrounding structures, particularly the internal and external anal sphincters and the conjoint longitudinal coat (CLC). One of challenges to reveal such relations is how to demonstrate the structures at both macroscopic and microscopic levels. The aim of this project was to use the ultra-thin E12 plastinated slices to identify the CLC and AGs. Methods: A total of 10 adult (4 females and 6 males, aged 37-81 years old) and 6 infant (1 female and 5 males, aged 4 days - 3 months old) cadavers were used in this study. The 200µm-thick transverse or longitudinal sections were collected from three cadavers and examined under a stereomicroscope microscope or confocal microscope. The remaining cadavers were prepared as 5µm-thick sections stained with H.E. or van-Gieson or Verhoeff's elastin staining. Results: (1) The CLC, AGs and anal sphincters were clearly demonstrated in the E12 slices and infant and adult histological sections. The best histological features were present in the infant specimen. The epithelial layer was often damaged during preparation of both E12 slices and adult histological sections. (2) Compared to the histological sections, the ultra-thin E12 slice revealed a much better configuration of the CLC and its relation to the AGs and sphincters. (3) The CLC is superiorly continuous with skeletal muscle fibers of the pelvic diaphragm and inferiorly fans out, penetrating both internal and external anal sphincters. (4) There is no clear evidence to show that the CLC anchors onto the AGs and mucosal layer or skin. Conclusion: The CLC is the tendinous portion of the pelvic diaphragm and seems not associated with the AGs.

Fascia and sheet plastination. ***Zhang M***. *Department of Anatomy & Structural Biology, University of Otago, Dunedin, New Zealand.*

Background: Terminologia Anatomica (TA) recommends that the term "fascia" is a sheet of fibrous tissue that envelops the body beneath the skin and also encloses and separates muscles, whereas the term "tendon" is a fibrous band that is the part of the muscle, which connects the fleshy (contractile) part of the muscle with its bony attachment or other structures. However, such definitions may be overstated and may represent figments of various anatomists' imagination. In the case of the bicipital aponeurosis, for instance, this tendinous structure fans out and eventually continues with the deep fascia of the forearm. In other words, the deep fascia of the forearm must at least partially consist

of tendinous fibers. The aim of this presentation is to explore the relationship between the fascia and muscular structures in the various regions of the body. Methods: Retrospective analysis of the studies that were undertaken by our group to investigate fascia configuration in the various regions of the body using the sheet plastination technique [1-9]. Results: (1) Nature of the so-called fascia is much more complicated than what we thought before. The major difficulty in studying configuration of fibrous tissue is that its delicate structure lacks a clear demarcation from the surrounding tissue and thus is damaged or altered easily during dissection. Although histological examination may overcome the problem, application of such method is greatly limited by the size of sample areas. The sheet plastination provides a new approach to elucidate the configuration of the connective tissue at macroscopic and microscopic levels. (2) There are a number of direct evidence to demonstrate that the majority of fibers in the fascia are derived from the muscle tendon. The key difference between a fascia and a tendon is the compactness of connective fibers rather than their origins and/or locations. Conclusion: The sheet plastination technique provides a novel approach to verify the configuration of the fascia in a given region of the body.

3D fluoroscopy reconstruction of plastinated specimens. ***Latorre R[1], F SUN[2], O López-Albors[1]; MD Ayala[1], F Gil[1]; S Losilla[2], M Orenes[1], RW Henry[3]***. *[1]Veterinary Anatomy, Univ. of Murcia, Spain, [2]Minimally Invasive Surgery Centre, Cáceres, Spain, [3]College of Veterinary Medicine, Univ. Tennessee, USA.*

Background: Radiology has been routinely used for evaluation of bony structure and soft tissue in imaging diagnosis. However the superimposition of adjacent osseous structures and difficulties in positioning for multiple views of complex anatomy regions make difficult the interpretation of the radiographic views. Conventional radiography on cadavers has been used in gross anatomy courses to offer a radiographic-anatomic-pathologic correlation and to facilitate understanding of complex anatomical relationships. Teachers of anatomy and radiology would agree that the use of gross tissue specimens in the laboratory is an invaluable aid for radiographic study of normal and diseased structures. However, the preparation and handling of such material is difficult. In this sense, plastinated specimens provide the potential for infinite use as tools in radiology courses. In this project we show the three-dimensional (3D) fluoroscopy imaging properties that can be obtained from plastinated specimens. Material and methods: Five thoracic and five pelvic limbs from embalmed dogs were dissected prior to plastination. The specimens were prepared and plastinated according to the standard S10 Biodur silicone procedure. Several 3D images from the limbs were acquired using a C-arm (BV Pulsera 3D-RX Option. Philips. S. A.). The C-arm rotates continuously through 200º in a 30 second period while acquiring a large set of 450 high-definition fluoroscopic images. The complete set of images was integrated to create a high-quality 3D volume reconstruction. Results: 3D reconstruction of the different regions and joints allowed an easy identification of the main muscles and bones. In order to provide good anatomical detail of the different bony structures, subtraction of the soft tissue was possible. Also, rotation in the three planes permitted a clear viewing of the relationship between different bony structures. Conclusion: Silicone plastinated specimens can be a useful tool to teach and understand the radiographic images. Also, if radiographs are taken before plastination, then the plastinated specimen can be used for comparison.

Computerized 3D anatomical modeling using plastinated anatomical material. ***Tunali S[1,2], M Farrell[2], S Labrash[2], BK Lozanoff[2], S Doll[3], S Lozanoff[2]***. *[1]Hacettepe University, Ankara, Turkey, [2]University of Hawaii, Honolulu, HI, USA, [3]University of Heidelberg, Heidelberg, Germany.*

Background: Computerized 3D anatomical models are routinely used for instructional purposes in the medical education classroom as well as the clinic for explaining diagnosis and treatment options. The advantage of this technology is that complicated three-dimensional morphology can be visualized providing important insights into anatomical spatial relationships. However, the process of obtaining these models remains laborious, complex, and expensive since they are typically generated from 2D section material whose images are proprietary. Even if a suitable conversion program is identified, the process of generating the rendered model requires highly sophisticated equipment unavailable to the typical educator. Plastinated specimens on the other hand, provide a ready source of anatomical material suitable for rapid and reliable modeling. The purpose of this study was to develop a simple system for generating 3D computerized models using plastinated specimens. Methods: Anatomical specimens were obtained and plastinated using the Dow/Corcoran method at room temperature. Specimens were dehydrated in a graded acetone series at -20°C, dehydration time was 2 to 3 weeks depending on the size of the specimen. Then specimens were immersed in

COR-TECH TM PR-10 silicone polymer (Corcoran Laboratories) mixed with 7% cross linker (CR 22 TM) and vacuum was applied. After 3 days of vacuum, no acetone bubbles were observed, impregnation was complete and vacuum was discontinued. Specimens were drained of excess polymer for two days and then brushed with catalyst (CT 32 TM). They were kept in a closed pot containing some drops of catalyst and water for one week. Then, they were put in zipper plastic bags for further curing for one more week. Finally specimens were ready for three-dimensional modeling. Specimens were digitized using a hand held scanner (Polhemus), exported in .obj format into Maya software where they were edited, and exported as .dxf files. Subsequently, they were converted to .xdf files and read into WinSURF (SURFdriver Software), partitioned into individual objects and saved. An icon-driven interface called SURFviewer, was developed and implemented providing a simple desktop application for viewing the models. Results: Models were viewed and qualitatively compared to the actual plastinated specimen and showed close correspondence. The names anatomical structures on the models were successfully viewed and heard via audiovisual files. Conclusion: It is concluded that this system provides a simple yet effective reference tool for anatomical education in multiple languages. Further work will be directed at increasing the database and implementing it in conjunction with an electronic laboratory guide.

3D multidetector CT reconstructions of a diencephalon and brain stem, plastinated with Biodur using the standard S10 technique. ***Cerqueira EP, CAC Baptista, CC Campi, AF Silva***. *University of São Paulo, São Paulo, Brazil.*

In clinical and anatomical practice, comparison between plastinated specimens and Computed Tomography (CT) and Magnetic Resonance (MR) examinations are normally used. However, the direct examination of specimens by CT may be performed for evaluation of its internal and external structures, and to ascertain whether their integrity can be an important value in gross anatomy teaching. It was utilized a Toshiba Aquilion 64-multdetector CT scan, at Radiology Department of the Heart Institute – University of São Paulo/Brazil, to evaluate a diencephalons and brain stem specimen, plastinated in 1986, by Biodur S10 standard technique. It was obtained several cross-section images from the specimen with 0.5- mm slice thickness and 0.5-mm image reconstruction interval. 3D images were reconstructed through MIP (Maximum Intensity Projection) and VR (Volume Rendering) techniques at Aquarius Net Viewer Workstation of TeraRecon Company. Also, it was measured the rate of CT attenuation coefficient (UH) of specimen images and compared with those obtained from white and grey matter of a live brain CT scan images. As far as the anatomical aspect is concerned, the internal and external morphological structures were preserved, especially inside the third ventricle and outside the midbrain, after twenty-two years of its plastination. 3D reconstructions of the specimen showed high spatial resolution, with great detail - state of art - of their anatomical structures. By the Radiological imaging view, the specimen showed an increased attenuation rates, compared with the grey and white matter in live brain images, but less than the attenuation values of any kind of calcification. It was not possible, by CT, to recognize the grey and white matter of specimen. CT scan is an excellent method for assessing plastinated specimens, especially to reveal and evaluate either inner or outer surfaces, but not to differentiate their wall structures. Also, the Biodur S10 alters the CT attenuation rates of specimen.

3D multidetector CT reconstructions of a heart, plastinated with Biodur using the standard S10 technique. ***Cerqueira EP, CAC Baptista, CC Campi, AF Silva***. *University of São Paulo, São Paulo, Brazil.*

In clinical and anatomical practice, comparison between plastinated specimens and Computed Tomography (CT) and Magnetic Resonance (MR) examinations are normally used. However, the direct examination of specimens by CT may be performed for evaluation of its internal and external structures, and to ascertain whether their integrity can be an important value in gross anatomy teaching. It was utilized a Toshiba Aquilion 64-multdetector CT scan, at Radiology Department of the Heart Institute – University of São Paulo/Brazil, to evaluate a heart specimen, plastinated in 1986, by Biodur S10 standard technique. It was obtained several cross-section images from the specimen with 0.5- mm slice thickness and 0.5-mm image reconstruction interval. 3D images were reconstructed through MIP (Maximum Intensity Projection) and VR (Volume Rendering) techniques at Aquarius Net Viewer Workstation of TeraRecon Company. Also, it was measured the rate of CT attenuation coefficient (UH) of myocardium specimen images and compared with those obtained from myocardium of a live heart CT scan images. As far as the anatomical aspect is concerned, the internal and external morphological structures were preserved, especially inside where the valves, ridges and bridges (trabeculae carneae), fibrous threads (chordae tendineae) and papillary muscles where greatly

represented, after twenty-two years of its plastination. 3D reconstructions of the specimen showed high spatial resolution, with great detail - state of art - of their anatomical structures. By the Radiological imaging view, the specimen showed an increased attenuation rates, compared with the myocardium in live heart images, but less than the attenuation values of any kind of calcification. It was not possible, by CT, to recognize the layers of myocardium wall of the specimen. CT scan is an excellent method for assessing plastinated specimens, especially to reveal and evaluate either inner or outer surfaces, but not to differentiate their wall structures. Also, the Biodur S10 alters the CT attenuation rates of specimen.

Visitor reactions to plastination. ***Moore CM[1], CM Brown[2]***. *[1]University of Texas Health Science Center at San Antonio, Texas, USA, [2]Trinity University, San Antonio, Texas, USA.*

Background: Until the advent of plastinated cadavers, few outside the medical professions have had firsthand experience with human corpses. Such opportunities are now available at the Body Worlds exhibits of Gunther von Hagens and other traveling plastination exhibits. This report examines philosophical and religious responses of visitors to several Body Worlds exhibits around the globe to illuminate cultural issues surrounding this new format for the scientific education of the public. Materials and Methods: We limited our examination of visitor responses to comment books available to the public exiting Body Worlds exhibits. We perused over 2500 comments from books in London, Toronto, Singapore, Cleveland, Houston, and Denver. The Institute for Plastination provided us with copies of consecutive but random pages containing approximately 400 responses from each exhibit. We analyzed the responses with an eye to themes of general cultural, philosophical, and religious significance. Results: A large variety of overlapping issues emerge from the comments. Four overarching themes in the form of questions encompass the greater part of visitor comments and reflect major ongoing tensions in society at large: (1) What is life in its relation to death? (2) What do these bodies reveal about our relations with others and our place in the universe? (3) Are these plastinates freak displays or sacred relics? (4) What is the origin of these complex machines we know as our bodies? Under each of these questions we found thoughtful— and not so thoughtful—meditations on personal and social identity, on the individual's relationship to the universe and/or to God, and on the meaning and purpose of life. Religious concerns frequently permeated the comments, although not always in expected ways. Religiously conservative visitors in the United States, for instance, frequently thanked the creators of Body Worlds for providing evidence for the Master Creator and had little problem with the "nudity" of the plastinates as this is how God created humans in the Garden of Eden. However, no consensus emerged on sensitive cultural issues regarding abortion, evolution and intelligent design, and the existence of a soul apart from the body. For those visitors who commented on our relation with others, however, there was broad agreement that there is an underlying unity that transcends race and gender. Conclusion: Visitor comments form a microcosm of social debates on emotionally-charged subjects such as evolution and creationism and pro-life issues. While most responses represent visceral reactions to the plastinates with little understanding of the underlying science or of the scientific method, the exhibits are clearly a way for laypersons to learn about their body. The responses from various cultural, ethnic and socially diverse regions of the world are surprisingly uniform, and overall very positive, regardless of religious and philosophical persuasions.

Ethics in plastination. ***Whalley A***. *Institute for Plastination, Heidelberg, Germany.*

With the Invention of Plastination, a new classification for permanent anatomical specimens was introduced. However, an accord on the ethical use of specimens has been far from officially established. Before plastination, anatomical specimens had never been so accessible to the general public. At the same time, the use of plastinates in the medical field, for teaching and training is growing at exponential levels. The popularity of Plastination has started a wave of universal discussion by ethicists, religious leaders, the public, media, members of the scientific community and most recently, lawmakers. Established standards for ethical display and use of plastinated specimens, have at this time, only been set at the discretion of the scientists working in the lab. Origins of specimens, cultural concerns, human dignity and the profits generated from Plastination, have all led to discussions based on values and opinions. It is important to recognize ethical standards that can and have been adhered to by leaders in the world of Plastination; and at the same time it is necessary to examine cases where ethical standards are not in place, and discuss the necessity for setting controls.

Plastinates in medical education - a new approach at the medical faculty in Mannheim. ***Kriz W***. *Ruprecht-Karls- University Heidelberg, Medical Faculty Mannheim, Germany.*

Two years ago the Medical Faculty in Mannheim, University of Heidelberg started a new preclinical curriculum that follows a strict modular system. Thus, the curriculum is subdivided into functionally defined units, e.g. a module dealing with the locomotor system, with the respiratory system, with the endocrine system etc, in total eight modules. Within each module the relevant anatomical, physiological and biochemical facts were taught in strict integration. Such a system does not correlate with a classic dissecting course. Therefore dissections were greatly reduced in time and placed toward the end of the term close to the final examine. Within each module anatomy was presented with the help of "objects", i.e. anatomical models and plastinates. Together with the Department of Plastination in Heidelberg the teaching rooms (for maximally 12 students) were equipped with models and a rich spectrum of plastinates including silicone specimens and transparent epoxy slices. To give an example: for the module "locomotor system" the inventory of plastinates consisted of plastinated specimens of the main joints, of both the upper and lower extremities, of whole body plastinates and of transparent cross sectional slices through all major regions of both extremities. Evaluation: This kind of modular teaching was well received by the students. Together with the models, the plastinates were extremely helpful in demonstrating the three dimensional arrangement of muscles, tendons, fascia, nerves and arteries. According to our experience the plastinates should show the major structures of topographically relevant regions. Details, such as cutaneous nerves may be omitted; they can equally be well studied in models. Transparent slices were included in the lessons starting from the very beginning; they produced a surprisingly great success. In contrast to the three dimensional specimens, the slices contain every detail in unaltered topography. Learning Anatomy with the sheets stimulated the students to think about anatomical relations finally to think about topography. This led among students to vivid discussions, which essentially contributed to the learning effect. Combining transparent slices with CT or MR pictures increased the interest of the students and will probably be very useful for their future duties. Summary: Teaching anatomy predominantly with plastinates and models is successful and in several aspects superior to teaching anatomy along with dissection, Nevertheless, a dissection course, even if only a short one, is desirable and is strongly wanted by the students. We placed this course close to the final exam taking advantage from the advanced anatomical knowledge of the students that made the dissections extremely fruitful for them.

Plastinated, museum-based prosected specimens and web assessabled images are essential infrastructure for modern education in human gross anatomy. ***Pang SC, C Reifel, R Easteal, LW Mackenzie, R Hunt***. *Department of Anatomy and Cell Biology, Queen's University, Kingston, Ontario, Canada.*

Human Gross Anatomy is an integral part of medical education. However, over the past 10-15 years, there has been tremendous pressure in the North American medical curricula to reduce the amount of basic science teaching, including Gross Anatomy and Histology, in order to accommodate topics such as Cell and Molecular Biology and to lengthen the time for clerkships. Furthermore, as the patient population in Kingston, Ontario is unable to provide the essential experience for increasing numbers of medical students, it is necessary to expand our campus to include hospitals in the surrounding vicinities. The Department of Anatomy and Cell Biology at Queen's University has an extensive collection of prosected human gross anatomy specimens housed in its Anatomy Learning Centre. In order to be able to deliver our learning materials on anatomical subjects to students with various anatomy backgrounds and to those located at distant sites, the Department established a web-based Gross Anatomy and Histology Image Catalogue (GAHIC). Students can gain access to these learning materials anywhere in the world and at any time. The Anatomy Learning Centre remains the main site for self-directed learning (SDL), problem-based learning (PBL) and team-based learning (TBL) modules. Over the past 15 years, the demand for anatomy specimens has increased with the surge in numbers of students enrolled in the Medical, Nursing, Rehabilitation Therapy and Life Sciences Programs. As a result, the numbers of body donations to Queen's University have become insufficient to keep up with these demands, and we have produced plastinated gross anatomy specimens in order to reduce the cost in preparation of cadaveric specimens and extend their life span. In our Anatomy Learning Centre using both wet-prosected and plastinated specimens as well as a web-based image resource; we have been able to serve approximately 2000 professional and undergraduate Life Sciences students with an annual body donation number of approximately 20. Most plastinated gross anatomy specimens have a life span between 5-7 years, and have become an essential infrastructure of a modern anatomy learning facility.

Clinical relevance in teaching neuroanatomy - integrated course based on PBL and plastinated specimens. ***Weiglein AH***. *Institute of Anatomy, Medical*

University Graz, Austria.

For the student neuroanatomy is usually considered to be the most difficult topic in anatomy. One reason for this is that structures and functions do not simply correspond like in other organ systems. A second reason is that learning morphology by itself does not initiate comprehensive understanding and clinical reasoning. To overcome these problems, neuroanatomy at the Medical University Graz is thought in a five weeks integrated course covering macromorphology, micromorphology, developmental and functional anatomy. Since the neuroanatomy course follows immediately after the musculoskeletal course, the peripheral nervous system is thought at the beginning of the neuroanatomy module. After an introduction on the brachial and lumbosacral plexus demonstrated by P-35 plastination procedure the major landmarks are discussed and the students are requested to place wax cords representing the major peripheral nerves into the musculoskeletal specimens they have dissected during the musculoskeletal course. The correct placement is checked and common peripheral nerve lesions (e.g.: radial palsy after humeral shaft fracture, carpal tunnel syndrome etc.) are discussed based on the topographical anatomy. Morphological and functional systems of the central nervous system are taught parallel. After three weeks of introductory lectures, the students study brain and spinal cord models and plastinated brains and brain slices. To put more emphasis on clinical applicable knowledge, the students are viewing CT and MRI scans parallel with the brain slices. Since we teach 180 students parallel in one course, the quantity of P-35 brain slice sets was overcome by a trick. One series of axial P-35 brain slices was digitized and multiply printed on transparencies. The transparencies were then mounted between two Plexiglas plates and finally cut to the desired size and format. After studying the models and slices the students dissect a brain to enhance three-dimensional comprehension. To facilitate clinical reasoning the course ends with a PBL-seminar discussing and solving common clinical neurological problems. The evaluation of the course validates the integration of structure and function and the introduction of sectional anatomy and problem case. In the open questions (what was best?) both the practical course and the PBLseminar are mentioned most frequently: „practical realization of neuroanatomy in brain dissection and studying plastinated brain slices enhance comprehension"; „PBL-seminar at the end (not at the beginning) improve clinical understanding, since what we have heard and learned becomes more comprehensible and lively, clinical correlations become clear".

Exploring new horizons of plastination applications in medical education. ***Raoof A, L Saab, H Zhao, L Liu***. *Plastination Lab, The University of Michigan Medical School, Ann Arbor, Michigan, USA.*

Background and Methods: New horizons for the use of plastinated specimens in anatomy education have been explored at the university of Michigan. These included the addition of structured lab visits in the undergraduate anatomy course syllabus; involving student in the preparation of selected plastinated specimens for the gross anatomy course; using colors to highlight neurovascular pathways; and encouraging students to work on a plastination research project that would enhance their anatomy and plastination knowledge. Results and Conclusion: The lab visits during the undergraduate anatomy course received a high approval by students as a significant tool in understanding complex anatomical concepts and their clinical correlation. The visit have been rated high in the regular course evaluation questionnaire, 79% of the students agreed that lab visits were useful in understanding essential concepts; 87% agreed that review sessions using plastinated specimens were helpful; and 83% agreed that the use of plastinated specimens during lab visits was useful. Similarly, the plastination lab has been accepting more students to participate in doing dissections and plastination for the gross anatomy course. The use of color in identifying neurovascular pathways on plastinated specimens has become a routine procedure in preparing effective educational tools to students. It is becoming increasingly evident that plastinated specimens are constituting a significant role in medical education.

Education in veterinary anatomy by plastination. ***Basset Aly A E***. *Plastination Laboratory, Faculty of Veterinary Medicine, Zagazig University, Zagazig, Egypt.*

Zagazig Plastination Laboratory was established at Faculty of Veterinary Medicine, Zagazig University, Egypt to enhance the education of Anatomy for both Veterinary and Human medical students.

The Plastination Laboratory was supported by a Project from Higher Education Enhancement Program Fund (HEEPF, 2nd cycle 2004, Code B-053-To). At this stage the Laboratory is designed for preparation of Plastinated specimens by Silicon 10 technique and P40. 200 Plastinated specimens were prepared and displayed in Plastination exhibition. In addition a web- based photo gallery was established. Results have been quite acceptable but the costs of polymer are very high. The Plastinated specimens were subjected to internal evaluation by students and staff members. In addition to

external evaluation by experts from other countries were consulted as peer reviewers. The analysis of evaluation sheets was positive. Accreditation is the aim to ensure that our faculty and graduates are recognized, compete world-wide and to meet society demand for veterinary services. Website for the plastination laboratory was established and can be used by students And staff members (zu.edu.eg./plastination).

Clinical plastination of the human heart for education in a cardiac center. ***Starchik D, S Marchenko, M Didenko***. *International Morphological Centre, Military Medical Academy, Saint-Petersburg, Russia.*

Background: Clinical plastination is of particular interest in field of cardiovascular surgery because it provides variety of opportunities for widening of clinical manner of thinking using natural plastinated specimens. Methods: For creating demonstrative specimens we used standard plastination techniques of hearts from cadavers with retaining its original shape but for particular clinical requirement and needs. The fixed hearts were undergone to impregnation with silicone or epoxy resin as well as in combination with corrosion techniques. Prosthetic heart valves, rings, electrodes and lights were implanted by dissection or after curing. Results: Innovative approaches to enhance the quality of educational process have been implemented. Several modifications of clinical plastinated specimens were developed: 1) modified types of surgical dissections to expose the valves, great vessels, coronary arteries and conduction system; 2) hearts with pathological changes in the to demonstrate tumors, congenital and acquired heart diseases, hypertrophy or dilatation of the left ventricle, atherosclerotic plaques in aorta and coronary arteries; 3) slices of the heart injected with colored silicone according to the long and shot axis ultrasound views as well as MRI projections; 4) hearts with mechanical, biological valves implanted as well as rings and electrodes. Conclusions: In addition to the traditional methods the clinical plastination technique has to be available in clinical centers as it allows to improve effectiveness of teaching of ultrasound, radiographic and surgical anatomy, procedures and techniques. It is necessary to combine routinely used diagnostic and surgical procedures with heart slices and plastinated specimens as it gives better understanding even to the specialists in terms of clinical necessities.

Plastinates and modern learning practices. ***Cunningham MDF, MK Chuang, LW Mackenzie, RA Easteal***. *Department of Anatomy and Cell Biology, Queen's University, Kingston, Ontario, Canada.*

Background: It is well established that plastinated specimens are extremely useful in the teaching of gross anatomy. Because of the availability of a large number of plastinated human specimens we were able to instigate a new approach to anatomy labs. In our anatomy department, where about six hundred students go through anatomy labs every week, time is clearly of the essence. How best to utilize that limited time for each student – how do you optimize the learning environment to fit the needs of each student? Two separate studies are presented. The first is an analysis of student learning modalities in two large anatomy classes using the VARK modality survey. The second shows the results of using Team Based Learning (T.B.L.) in an anatomy laboratory (T.B. Labs). The VARK study analyzed the distribution of learning proclivities in these classes; while the T.B. Labs investigation measured the efficacy of using T.B. Labs. What was hoped was that the introduction of T.B. Labs would allow students with disparate learning styles to maximize acquisition and retention of the material. Methods: 1. VARK Study – VARK measures learning modalities based on four styles of learning preferences, Visual, Auditory, Reading-writing and Kinesthetic (V.A.R.K). The study was conducted using the on-line version of the VARK survey and results were analyzed according to the established protocol. 2. T.B. Labs Study – Data were analyzed comparing students' marks from a year without the T.B. Labs and a year with the T.B. Labs. The analysis was performed using the Statistical Package for Social Sciences (SPSS). Results: The VARK study indicated that among the 280 students 72% were multimodal learners, of this group 64% were quadric-modal, 17% were tri-modal and 19% were bimodal. Of the uni-modal group (28%), 24% were visual learners, 18% were auditory learners, 25% were read/write learners and 34% were kinesthetic learners. T.B. Labs data indicated a significant positive effect of T.B. Labs methods over traditional laboratory methods. Conclusion: 1. The large number of plastinates enables us to provide hands-on specimens for the 6 teams in any given lab. We need 6 teaching specimens of each structure covered - a lot of specimens. Without plastinates we would not have attempted this initiative. 2. T.B. Labs enabled students with ANY learning modality to be accommodated; the auditory and read/ write learners would be on equal footing with the visual and kinaesthetic learners – not usually the case in anatomy. 3. The VARK survey allowed the students to become aware of their own limitations and advantages, which they could then optimize in the nurturing environment of their team.

Teaching anatomy in the Military Medical School of Mexico. ***Alva M***. *Escuela Medico Militar, Mexico City, Mexico.*

This paper shows the methods and resources used for teaching Human Anatomy in the Military Medical School in Mexico City, Mexico. Historical documents and graphic materials were integrated and converted to a DVD with short descriptions that allows a quick general view of how students and professors interact in the teaching-learning process. During and after the elaboration we concluded that the methodology and resources utilized in the teaching of Human Anatomy in the Military Medical School are good enough for the students to learn (as demonstrated through multiple evaluations), but we want to achieve higher levels, modernizing our methods and adding means (plastinated materials, imaging, endoscopy, etc.) in the search of a better knowledge of this important science.

The exclusive use of plastinates at the New York University Dental College. ***Diwersi N***. *Institute for Plastination, Heidelberg, Germany.*

In 2004, the New York University, College of Dentistry, largest dental school in the country, was the first US school to introduce a 100% non-dissection anatomy curriculum to use plastinated specimens exclusively as an educational tool. Two kinds of plastinates were to be used: dissected silicone plastinates and transparent body slices. At first the acceptance of the dissected plastinates was higher than that of the body slices, but after some familiarization it soon turned out that the plastinated body slices became first choice for problem based learning due to their detective value. Anatomy teachers as well as students appreciated the individual anatomical features of the slices and felt challenged to name all structures of the serial cut slices. Four years after their introduction, plastinated specimens have transformed the way anatomy is taught at NYUCD. Student evaluations proof that the use of plastinates has made anatomy classes more attractive. Statistics also show that there was a significant increase in performance on national board exams by those students that were the first to participate in the non-dissection anatomy curriculum with plastinated specimens.

The use of plastination (Biodur S10 technique) in teaching the large intestine of the horse. ***Diz A, JL López-Rivero, A Martínez-Galisteo, F Miró, MV Roddríguez-Barbudo***. *Department of Comparative Anatomy and Pathology, Faculty of Veterinary Sciences, University of Córdoba, Spain.*

Background: The knowledge of the large intestine of the horse is of great interest in Veterinary medicine as diagnosis of colic pain and post-mortem necropsy are very frequent in Veterinary practice. Due to its complexity and volume the teaching of the large intestine anatomy in Veterinary schools has not been an easy task. Fresh and formalin-fixed preparations has been traditionally used with the inconvenience of its large weight, flaccidity and difficulty in handling. The aim of the present study was to analyze the use and advantages of a plastination technique (Biodur S-10) in the teaching of the large intestine of the horse in Veterinary Anatomy. Materials and methods: The large intestine of three seven-month-old horses were obtained from the slaughterhouse. They were cleaned by means of water and fixed by using formalin (5 %) during a week. Then, the method of plastination with Biodur S10 technique was followed, but they were inflated and placed in an anatomical position previous to curing. Finally, the preparations were used in the teaching sessions of Gross Anatomy in the Veterinary School of Córdoba. Results: The plastinated preparations obtained by using the S-10 Biodur technique were a turning point in the teaching of the large intestine anatomy. Comparing to the use of traditional specimens the morphology and topography of this part of the digestive system were easier understood. It was observed that the students identified faster than before the cecum and the different parts of the colon in the necropsy room. Conclusion: Plastinated preparations of the large intestine are very useful in teaching the Anatomy of the horse. They have advantages compared to the traditional specimens such as fresh and formalin-fixed preparations. These are their less weight, the facility of handling, and, in addition, the lack of toxicity.

A learning model for cardiac catheterization. ***Tomasome J, W Kong, R Hunt, SC Pang***. *Department of Anatomy and Cell Biology, Queen's University, Kingston, Ontario, Canada.*

Cardiovascular disease is a leading cause of morbidity and mortality in modern societies and according to the World Health Organization (WHO) by the year 2015, an estimated 20 million people worldwide will die from cardiovascular diseases, mainly from heart attacks and strokes. One of the greatest advances to date in the management of cardiovascular disease has been development of a procedure to diagnose abnormal coronary circulation that is referred to as cardiac catheterization. This has lead to other procedures like percutaneous coronary intervention with angioplasty and coronary stenting which can be used to treat symptoms of cardiac ischemia and also be used in the acute treatment of heart attacks. Cardiology residents

require extensive training and experience in order to become proficient in cardiac catheterizations. However, hands-on learning models for cardiology residents to practice catheterization before performing this procedure on a living patient are limited. In this investigation, we sought to create a cardiac catheterization learning model using plastinated cadaveric material that would assist in the understanding of the anatomy involved, and the dexterity required, to perform this procedure. The heart, aorta and associated arteries were excised from an embalmed cadaver and cleared of all adhering connective tissue. In order to remove clotted blood, a longitudinal incision was made on the posterior aspect of the thoracic and abdominal aorta and then sutured closed prior to plastination. An aneurysm was present in the abdominal aorta just proximal to the bifurcation of the common iliac arteries. As the femoral artery is the most common entry point of cardiac catheterization, both of arteries were included in the model. The dissected specimen was bleached in 6% H2O2 solution, fixed in 5% formaldehyde, and stuffed with gauze to maintain the patency of all vessels prior to plastination. Following plastination, the specimen was mounted onto preformed plexiglass. Sheathed or diagnostic catheters (e.g. 6F JL 4 or 6F JR 4) were used for practice catheterizations. Angiograms were provided to illustrate the position and manipulation of the catheter in the specimen. This model specimen has been placed in the Anatomy Learning Centre at Queen's University to be used as a tool for teaching cardiology residents the skill of cardiac catheterization.

Classification of pig kidney collecting system: S10/S3 corrosion casts study. ***Pendovski L[1], V Ilieski[1], D Lazarova-Tosovska[2], B Trpkovska[2], V Petkov[1].*** *[1]Department of Functional Morphology, Faculty of Veterinary medicine – Skopje, R. Macedonia, [2]Institute for Anatomy, Medicine Faculty – Skopje, R. Macedonia.*
Background: The pig kidney has been well studied in terms of physiology. In recently published publications the anatomy of pig kidneys is described, but those data are generic and didn't offer details concerning the pig collecting system. The shortage of studies in witch the drainage pattern of minor calices is analyzed, according the literature, has an influence for applicability of pig kidneys in experimental procedures in urology. In this work we present detailed anatomical findings on pelvio-calice system in pig kidneys with aim classification of collecting system based of the drainage on minor calices into renal pelvis. Material and method: The material was consisted of 53 kidneys taken from adult mixed-breed Dalland, slaughtered at age 150- 155 days and weighing 95 kg (mean). The pig collecting system was studied on three-dimensional silicone-S10 corrosion casts. After removing the renal capsule and surrounding fatty deposit on each kidney a short flexible PVC-tube was ligated into ureter. Through the tube a mixture of silicone S10/S3 in ratio 100:1(volume 10-15ml) colored with yellow ink (2-3% of silicone mass) was injected into ureter. As a hardener, added to the silicone was S6 in a proportion of 5% injected silicone. After injection, each kidney was placed in appropriate anatomical position for 24 hours to ensure depth curing of silicon. The corrosion of injected kidneys was achieved by immersion in a bath of concentrated commercial hydrochloric acid for 48 hours until a complete organic matter was decomposed leaving only endocasts of the collecting system that had been injected. Result: The renal pelvis and two major calyces or infundibulae (one cranial and one caudal) were founded in all investigated pig kidney collecting systems. The number of minor calices per collecting system was ranged from 5 to 17 (mean 9.02) and the cranial pole presented significant more minor calices then the caudal pole ($p<0.05$). Based of drainage into mid-zone of renal pelvis, the collecting system was classified into two groups. Group I was composed of kidneys (55.48% of cases) in which the drainage of renal pelvis mid-zone was performed by two major caliceal groups. The first group was drained directly into cranial infundibulae and the other major caliceal group was opened into caudal infundibulae. The both groups separately and simultaneously could drain into mid-zone of renal pelvis. Besides appointed two major groups of calices, in group II of kidneys (44.52% of cases), we found minor calices that were opened on the lateral margin for entire length of the renal pelvis. Those calices could drain independently and simultaneously with major groups of minor calices into mid-zone of renal pelvis. Conclusion: Except in plastination process, the silicon S10 showed that could be used as an injection material for preparing corrosion cast. The obtained casts are imperishable and flexible with well preserved anatomical details. The yellow ink added to the silicon mixture enable a good color visualization of casts allowing for better impetration of anatomical structures. The pelvio-caliceal S10 endocasts showed that are reliable copy image of original on witch the anatomical features at pelvio-caliceal system as its drainage pattern can be investigated. The classification of pig pelvio-caliceal system could be used for diagnostic imagining during interpretation on pyelograms, kidney ultrasound images and MR or CT kidney scans. The obtained data will increase the knowledge about the collecting system in

pig kidneys and will have influence for their future application in experimental endourology.

Body donation, management & museum techniques in Nigeria. ***Azu OO***. *National Postgraduate Medical College of Nigeria, Lagos, Nigeria.*

The practice of body/tissue donation is still seen as an alien tradition in Nigeria. The collection and display of human body parts in museums have been a common practice all over the world. Due to the low level of awareness, cultural beliefs, religious and ethical factors, most Nigerians are ignorant of the benefits of or otherwise of body parts in the training of personnel in the medical discipline as well as for research purposes. This has been responsible for the scarcity of cadaveric materials for use in the teaming medical schools and research institutes who are pressed to seek for cadavers by different ways. There is the belief by some Nigerians that the dead should be accorded their resting place-at the grave. Hence, when the mention of autopsy is done for deceased persons, relatives are the first to object to this, claiming that it dismembers and renders the deceased incomplete for burial. At the National Postgraduate Medical College of Nigeria, body parts used for museum demonstration are basically obtained via donations from tertiary hospitals/centers spread across the country. These donations cover a diverse range of specimens/tissues on pathology (surgical and post-mortem), anatomical dissections, skeletal materials as well as rare collections of relics, reptiles and objects of relevance for postgraduate teaching and research. The museum of the College handles the preparation of these specimens to the final presentation/use in pots or jars. With no plastination center in the West African sub-region, there is the urgent need for the establishment of a plastination laboratory in the museum of the College to provide a rallying point for the future training of experts in the field of plastination. We expect also the greater sensitization of anatomists to take part in the surging public interest in the issue of body donation and the formulation of necessary laws to guide body/organ use in Nigeria.

Suitable equipment for plastination. ***Von Hagens G***. *Gubener Plastiante GmbH, Guben, Germany.*

Proper equipment in Plastination is a must for the manufacture of high quality plastinates. This presentation will present equipment and auxiliaries for silicone and sheet plastination. The pros and cons of alternatives in vacuum chambers, vacuum pumps, separation foils and the like will be discussed. Safety requirements for health and fire hazards will complete the presentation.

Possible pitfalls and improvements of the standard silicone technique. ***Von Hagens G***. *Gubener Plastiante GmbH, Guben, Germany.*

Thirty one years after its invention the most common and the most dangerous pitfalls in plastination can clearly be named. The greatest challenge is to minimize or even prevent overall shrinkage during dehydration, impregnation and curing. In order to achieve this goal a proper diagnostic has to be made, because the reasons for shrinkage can be manifold. The main reasons are insufficient fixation, incomplete dehydration, over-long degreasing and insufficient curing. Improvements have been made by using various surface treatments with the aim of upgrading the final appearance of the specimens. The presentation will show the pitfalls and improvements of standard plastination techniques in pictures. The original plastinates can be evaluated during the visit to the Plastinarium in Guben.

A plastinated human cadaveric model as a realistic simulator for oral endotracheal intubation skills training. ***Ammerata A, R Hunt, C Reifel, R Easteal, L Mackenzie***. *Department of Anatomy and Cell Biology, Queen's University, Kingston, Ontario, Canada.*

Background: Oral endotracheal intubation is a critical care procedure that requires competent acquisition of skills by the trainee. Simulation in medical education provides an interactive, hands-on option for the trainee to practice technical procedures prior to performing the procedure on live patients. Although simulation as a teaching strategy in clinical education has proven successful, ongoing concern is use of simulators of varying fidelity. Synthetic simulators are available (i.e. rubber manikins, plastic and wood models), as well as animal models. In this study we have embarked on a project to prepare a plastinated human specimen for simulation of oral endotracheal intubation. Materials & Methods: An embalmed cadaver was chosen for the model based on the esthetics of the head and neck dissection (i.e. clearly visible muscles of the face and neck, open mouth, eyelids closed). Since only the head, neck, and superior mediastinum were required, the remainder of the body was removed. The posterior thoracic cage proximal to vertebrae T6 was maintained to provide the model with structural support. The superior mediastinum was dissected to show the trachea, bifurcation of the trachea, proximal portions of the primary bronchi and esophagus. The dissected specimen was bleached in 6% H2O2 solution and fixed in 5% formaldehyde prior to further dissection. To provide the mandible with mobility, the masseter muscles and parotid glands were removed, as well as any tissue beneath the zygomatic arch. The temporalis,

medial and lateral pterygoid muscles were left intact to maintain stability. Additionally, the posterior neck muscles were removed to the layer of the splenius capitis and splenius cervicis muscles, as well as both clavicles. To provide maximal mobility to the temporomandibular joint, the lateral temporomandibular ligament and fibrous capsule of the temporomandicular joint were cut and the condylar processes of the mandible were removed. A polytetrafluoroethylene tube was inserted into the trachea and esophagus to maintain their patency prior to plastination. The specimen was plastinated using the standard S10 method. Results: The plastinated, dissected human cadaver model presents realistic anatomy of the upper airway. The model allows for all of the movements to perform the procedure of oral endotracheal intubation, i.e. neck flexion, occiput extension, mandible elevation and depression, and lateral displacement of the tongue necessary for the visualization of the epiglottis and vocal cords. The instruments for intubation can be positioned and manipulated using this model, and it allows for proper intubation of the trachea, as well as incorrect intubation of the esophagus. Conclusion: The plastinated human model provides a realistic human intubation simulator. Trainees can practice and acquire the skills and dexterity to perform this procedure without risk to the patient. This learning model is effective and practical for training.

Using plastination specimen in laboratory for co-medical students. ***Taguchi M***. *Dept. of Anatomy, School of Allied Health Sciences, Kitasato University, Sagamihara, Japan.*

In the human anatomical lab, human specimens are indispensable. But co-medical students in our university do not dissect human body. Accordingly our students dissect fetal pig instead of human body to learn body structures. Our using fetal pig is about 30cm (head to hip) and 1500g. We prepared plastinated fetal pig specimen for student who dissect animal for the first time of their life to show how to dissect step by step. Several patterns of specimen are prepared, e.g. showing the nervous system, the muscle system, the abdominal viscera and etc. Moreover the students who have failed to dissect certain part structure can review once more. Plastinated specimens help the students to understand body structure.

Teaching the anatomical structures of the hand: a comparative study using prosected plastinates (S10) and dissection. ***Baptista CAC, CAC Bennett-Clarke, RD Lane, M Thorpe, C Shriner***. *University of Toledo, College of Medicine, Toledo, Ohio, USA.*

The importance of dissection in the human anatomy labs to teach the fundamentals of the human body is emphasized by the fact that 97% of medical schools in US require their students to participate in cadaver dissection. Although most anatomists consider dissection to be essential to anatomy, many departments are under pressures to reduce/eliminate dissections from the curriculum. The time pressure in medical school programs, reduction in the number of qualified faculty and advances in technology have also called into question the time vs. value for cadaver dissections. Another challenge to this teaching method has come directly from the AAMC as they encourage self-directed and student-centered pedagogies. These strategies emphasize problem-solving and development of clinical reasoning rather than memorization of content. At UT COM, we have the opportunity to examine the impact of plastinates on efficiency of student learning in the anatomy lab. However, the faculty would like to ensure that plastinates will have a positive impact on student learning before we adopt them in our course. For this study human hands were plastinated by the S 10 standard cold-temperature technique using North Carolina NCSX/NCXIII polymers. Students were asked to participate in the study which included one lab session (3 hours). The lab was conducted in the gross anatomy laboratory and replaced the regularly scheduled lab for those students. Prior to the start of the lab session all students completed an eight question pretest, similar in format to a standard practical examination. Students were asked to identify "tagged" structures using a multiple choice question format. Students were given 8 minutes to complete the pretest. Students were randomly placed in two groups. Group 1 (N= 10) completed the standard dissection of the hand following the instructions provided in the lab dissector and the lab instruction packet. The students in Group 2 (N=9) were given all of the same resources during the lab period, however, they used plastinated prosected hands to learn the lab content. When the students finished their instruction/dissection they completed a post-test in the same format of the pretest (8 multiple choice questions). Students also filled out a brief survey regarding the time investment and the satisfaction of the learning accomplished during the session. Comparision of pre- and posttest mean scores for both groups showed that there was no significant statistical difference between the groups. There is no negative impact on student learning when students use plastinates instead of cadaver dissections. Less time was required to complete lab assignments if students use plastinates to support cadaver dissections in the anatomy lab. Students found

plastinated specimens easy to work with and important structures were easy to locate.Overall students felt that time spent in lab was more productive when using plastinates.

Anatomical collection as a teaching and learning method in riga stradins university: a review of the evidence. ***Kazoka D, M Pilmane, J Vetra***. *Institute of Anatomy and Anthropology, Riga Stradins University, Riga, Latvia.*

Background: Human anatomy is complementary basic medical science, which is generally taught to medical students, physiotherapists, nurses, students of certain biological sciences, medical doctors and doctors working in some diagnostic specialties. Alternatively, human bodies can be preserved for human body exhibits to help others understand the complexities of the body by direct reference and observations. The aim of this study was to analyze anatomical collection as a teaching and learning method in Institute of Anatomy and Anthropology in Riga Stradins University. Methods: The collection of distinguish Latvian surgeon and oncologist Pauls Stradins (1896 – 1958), who has collected material from patients during surgery, was opened on 31st January in 2003. It is located in the building of Institute of Anatomy and Anthropology in Riga. This collection contains over 1000 high quality anatomical, 89 wax preparations, slides and photographs illustrating different diseases, injuries and realities of abnormal childbirth and animals. The author of wax models is famous sculptor – Janis Stradins and his collaborators. Generally, the same collection is created in the process of scientific research work of the Institute teaching staff and students. The majority of collection is organized in systems format and in regional format, in macroscopic and microscopic levels. The main part of all anatomical preparations (dissections) are in closed glass boxes (in 5% formalin). Results: The collection is valuable source of information for students of Medical faculty, Dental faculty, Medical History and public service organization at the Riga Stradins University. Students learn gross anatomy from models, photographs, lectures and tutorials. The study of gross anatomy using collection requires students to utilize two different learning strategies, the memorization of a large and complex medical vocabulary and the visual recall of three-dimensional structural relationships within the body. The study of microscopic anatomy (or histology) can be aided by practical experience examining histological preparations (or slides) under microscope; and in addition, students generally also learn anatomy with practical experience of dissection and inspection of collection. Dissections develop both learning techniques, and collection-aided teaching provides an important alternative pedagogical tool. In addition to these educational functions, physicians and students use collection as sources of illustrations for lectures, articles, and books. Conclusion: This unique collection is a basis of significant teaching and learning, research work and demonstrates an excellent exposition. It represents knowledge and understanding of the functional and structural changes in disease.

Computed tomography imaging of the equine temporormandibular joint: a sheet plastination study. ***Rodríguez MJ[1], A Agut[1], O López-Albors[2], J Arredondo[3], JM Vazquez[2], G Ramirez[2], R Latorre[2]***. *[1]Medicine & Surgery, and [2]Veterinary Anatomy, University of Murcia, Spain, [3]Fac Veterinary Medicine & Zootech., Autonomous Univ. State of Mexico.*

Background: Pathology of the temporomandibular joint (TMJ) is a challenge for clinicians due to its complex anatomy. This joint has recently gained high significance in a number of clinical problems (oral disorder and poor performance) therefore, several anatomical and biomechanical studies have been currently performed. Radiography has been the standard imaging method for the TMJ, however the interpretation of the images is difficult mainly due to overlapping of adjacent osseous structures. In human beings, CT has demonstrated a high sensitivity and specificity in assessing TMJ bone components. Furthermore, thanks to the recent development of helical multi-slice CT, three-dimensional re-formatted images can be obtained, this allowing a very realistic and spatially accurate reconstruction of TMJ structures which provides relevant information for a better planning and effectiveness of treatments. However, CT imaging interpretation requires a precise knowledge of sectional anatomy of the TMJ region. The aim of the study was to describe the normal crosssectional anatomy of the equine temporomandibular joint by using CT images and plastinated sections as anatomical references. Methods: CT evaluation was performed on eight temporomandibular joints from four pure-bred Spanish immature horses within the 2 hours of euthanasia to minimise post-mortem changes. A helical CT scanner (CT HiSpeed CT/e Dual; General Electric®) was employed to obtain contiguous 1 mm transverse slices. CT images were then re-formatted into sagittal and dorsal planes, transferred to an image analysis workstation (GE Advantage Workstation 3.1) and used to generate a three-dimensional model of the joint. Afterwards, the heads were firstly frozen at -30ºC for 48 hours and then cut off in blocks containing only

the TMJ. These blocks were frozen at -70ºC for 1 week to obtain 3 mm-thick transverse, sagittal or dorsal cryosections which were photographed and plastinated using the E-12 plastination method. Results: CT images and the corresponding anatomical sections were compared to achieve an accurate identification of the anatomy structures of the TMJ. Clinically relevant structures could be identified and labelled in both the CT images and the corresponding anatomical section. The best anatomical-CT depictions were acquired with the transverse images; they provided a detailed evaluation of the articular surfaces (articular cartilage and subchondral bone) of the zygomatic arch of the temporal bone and the mandibular condyle, and the relationship between the TMJ and the masticatory muscles, middle and inner ear. Conclusion: Plastination is an excellent method which provides full anatomic detail of structures of the TMJ in the horse to compare with novel imaging methods such as CT images from our study. This information may be a useful reference to assist clinicians in the interpretation and following diagnosis of the equine TMJ disorders.

Three dimensional reconstruction of the temporomandibular joint of a feline model by means of epoxy plastinated sections. ***Arredondo J[1], MD Ayala[2], O López-Albors[2], A Agut[3], JM Vázquez[2], F Asensio[4], E Latorre[2]***. [1]

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Background: Pathologies involving the articular and/or periarticular structures of the temporomandibular joint (TMJ) have been described in the cat. In most cases, surgery is necessary, however surgical approach of the TMJ is difficult due to complexity of the anatomical structures related to this joint. The use of epoxy plastinated slices allow accurate descriptions of complex anatomical regions and, in the end can be used for three dimentional reconstructions (3D). The aim of this work was setting up a 3D computer model of the anatomical structures of the TMJ of the cat from plastinated thin sections. This model will facilitate learning of this anatomical region in felines and assist surgeons when planning and carrying out surgical procedures. Methods: One TMJ of a cat that had undergone euthanasia for reasons other than temporomandibular joint problems was used in this study. The cadaver was frozen at -30ºC for 48 hours and a block containing the TMJ removed. The block was plastinated by epoxy impregnation E12-E1-E600 (Biodur®) and then cut into 0.4- 0.6 mm thick slices with a contact point diamond band saw. The plastinated slices were scanned and the images uploaded into 3D reconstruction software. Results: The thin plastinated slices provided a good anatomical detail of the TMJ structures and related. In the 3D model the osseous structures were particularly well reproduced. Subtraction of specific structures was possible; so all the elements in the model could be displayed in groups or as a whole, as well as rotated in the simulated 3D space. This facility increased the understanding of the anatomy of the TMJ and may be useful to assess surgical or clinical problems in this joint. Conclusions: The 3D model of the TMJ of the cat is a reliable tool to study this joint and could become a useful tool to plan standard and alternative surgical approaches in this or other feline species.

Epoxy plastinated slices of the temporomandibular joint of the cat are used to assess high resolution computed tomography. ***Arredondo J[1]; O López-Albors[2], A Agut[3], F Gil[2], M Soler[3], MJ Rodriguez[3], R Latorre[2]***. [1]*Faculty Veterinary Medicine & Zootechny, Autonomous Univ. of the State of México,* [2]*Veterinary Anatomy and* [3]*Medicine and Surgery, University of Murcia, Spain.*

Background: The study of sectional anatomy is a prerequisite to interpret image diagnosis techniques as computed tomography (CT), magnetic resonance imaging (MRI) and ultrasonography. High resolution CT can provide slices of approximately 1 mm thickness from a body region. Thin plastination can even go further, as 0.5 mm thick slices may be obtained from a band saw after epoxy embedding. The aim of this study was to correlate thin epoxy plastinated slices with high resolution CT images of the temporomandibular joint (TMJ) in the cat. This joint has a number of clinical problems that require a precise anatomical knowledge for a correct imaging diagnosis. Methods: The TMJ from one adult cat was used in this study. The cat had undergone euthanasia for reasons other than TMJ problems. A high resolution CT study was carried out within one hour of euthanasia. Transversal tomographic images were obtained and multi-planar reconstruction in the sagittal plane performed. After CT examination, the cadaver was frozen at -30ºC for 48 hours and a block containing the left TMJ removed. The block was plastinated by epoxy impregnation E12-E1-E600 (Biodur®) and then cut longitudinally into 0.4-0.6 mm thick slices with a contact point diamond band saw. A comparative description between the plastinated slices and the CT images was made. Results: In the CT reconstructed model the bonny structures of the TMJ were precisely reproduced. Muscles related to the TMJ

were also identified with this imaging technique. Similarly, in the thin plastinated sections the anatomy of the TMJ was observed in detail. Thus, an accurate anatomical correspondence between the plastinated sections and the high resolution CT images was found. Conclusions: Thin plastinated slices are a good alternative to correlate high resolution CT images of the TMJ in the cat. It is likely that they will also be useful to asses MRI images but, in this sense further studies are required.

The pig heart anatomy on thin S10 tissue slices. ***Ilieski V[1], L Pendovski[1], B Bojadzieva[2], V Petkov[1]***. *[1]Department of Functional Morphology, Faculty of Veterinary medicine – Skopje, R. Macedonia, [2]Institute for Anatomy, Medicine Faculty – Skopje, R. Macedonaia.*

Background: The gross anatomy teaching requires pictures, charts and models for the comprehensive knowledge of pig heart. It has been proved that sheet plastinated slices are excellent tools for demonstrating the topography of anatomical structures inside the specimens. E12 and P35/40 techniques in plastination are known as methods of choice for creating 3-5 mm or even 8 mm semitransparent or transparent organ slices. Those techniques also required equipment and polymers that not any plastination laboratory has. Specific in this investigation was measuring of decreased vacuum in vacuum chamber on daily basis. In our work we try to make relationship between level of decreasing of vacuum and speed of silicone impregnation. In order to display structure distinctly for study and researches we develop a protocol in which S10 method was applied to produce sheet plastinated slices. Material and Methods: One pig heart taken from pig mixed breed landras/jorksir was subject of S10 sheet plastination. The process of sheet S10 plastination was carried out as following: The fresh heart from pig was dilated with tap water under hydrostatic pressure to relax the muscle and to remove the remaining blood off its chambers. The dilated heart was fixed by immersion in 3% solution of formaldehyde for one week. After fixation, the slices of pig heart were cut with meat slicer into 3-5 mm thin slices. Each slice was market with serial number and placed between two stainless steel grids in a stainless steel basket. The basket with slices was rinsed with cold tap water overnight to get rid off excessive fixative. The dehydration of specimens was carried out with pure acetone in ratio 10:1 at –25°C. The basket with slices was submerged in first 100% acetone bath for 5 days. After first bath, the slices were transferred in second acetone baths for another 5 days. In the last, third acetone bath, the slices were kept until acetone concentration was at least 99% for three following days. For forced impregnation, the slices were submerged in a fresh S10/S3 mixture (100:0.05) for 3 days at –25°C. In a period of two weeks, the vacuum via a non-continuous method, was slowly increased until 5 bars was reached. When the impregnation was ended, the vacuum was decreased at atmospheric pressure and the specimens were left for another 3 days submerged in silicone bath at room temperature. In curing stage, the slices were removed from the vacuum chamber, and each slice was smoothed in towel so the silicone on the slice surfaces was removed. Finally, the gas curing method in gas chamber was applied and for another 2 days and the heart slices were completely cured. Results: The S10 sheet plastinated pig heart slices were obtained for a period of 5 weeks. The color of muscles on slices was maintained and the shrinkage was not evident. The slices are elastic, easy to orientated and offer a lot of anatomical details. The heart muscle fibers are clearly separated from each other and their shape can be followed for entire length of slice. The anatomical structures like different vessel ostia maintain their anatomical form. The chord tendons attached on ventricular surfaces at valves (tricuspid and bicuspid) can be seeing as originating form papillary muscles. Three-dimensional view of atria and ventricles can be completely reconstructed for their shape and size. Due to the thicknesses of slices and its transparency, the details of all anatomical structures can be reached. Conclusions: The S10 plastinated pig heart slices showed to be an excellent teaching tool in anatomy. With this slices students can view separate anatomical structures and they can handle reconstructed pig heart. Also they will be able better distinguish specific anatomical details in the internal structure of the level of 3-5 mm thick specimens. The knowledge of anatomy based on thin plastinated heart slices will help for better and more accurate interpretation of diagnostic CT / MR scans in clinical reveal. On other side, the S10 technique showed that could be used as method for producing the sheet organ slices. The method that we applied is relative easy to follow and uses affordable materials that are basic for plastination process.

Plastination of reptiles for veterinary education. ***Wendel H, R Stark, J Plendl***. *Faculty of Veterinary Medicine, Institute for Veterinary-Anatomy, Freie Universität Berlin, Germany.*

Background: Reptile medicine encompasses the medical needs of more than 7000 vertebrate species. So far, limited formal training for veterinaries is offered concerning anatomy of reptiles. Therefore a program was started dealing particularly on reptile anatomy,

comprising 14 one-hour lectures once a week. For these purposes whole-body specimens of different turtles, non-toxic snakes and saurians were plastinated at our institute. Method: Formalin (4%) was injected via a tube through the body orifices as well as via injection needles through the skin. After a fixation period of 4 weeks, specimens were dehydrated in 3 or 4 successive baths of acetone at a temperature of -25°C. Duration for each bath was 10 days. Subsequent degreasing in acetone or methylene chloride at room temperature was performed for a short period of time (10 days). Impregnation was carried out in a bath of silicone starting at a vacuum of 7,5 mm Hg; final vacuum was in the range between 2 and 0,5 mm Hg. After removing specimens from the impregnation bath and after a subsequent relaxation at standard pressure for 24 hours, curing with Biodur S6 in a gas hardening chamber followed. At first the specimens partly hardened at room temperature on grids. For the final cure, several injection needles were placed through the skin of the reptiles in hidden areas of the body. Gas curing was complete when the body surface appeared dry. Results and conclusions: The S10-technique according to Von Hagen (1985) was used successfully to plastinate different reptiles. Concerning methodology, some specifics have to be observed for plastination of reptiles: 1) Due to the thick and scaly skin of reptiles liquids and gas does not pass easily. Therefore immersion of the specimen into the fixative is not sufficient. Also, for the final cure several injection needles should be placed through the skin. 2) In case of long snakes it is important to place the body during the fixation period in the exact position requested. 3) Degreasing period has to be short because snakes have massive fat pads in their body cavity which need to be preserved.

Analysis and standardization of morphological types of intraparenchymal spatial distribution of the caudate branches of the portal hepatic vein. ***Matusz PL, E-C Hordovan, AM Pusztai***. *University of Medicine and Pharmacy "Victor Babes", Timisoara, Romania.*

Terminologia Anatomica (1998) homologates the caudate branches of the portal hepatic vein (PHV) having the origin from the transverse portion of the left branch. Lately, studies on corrosion casts performed at the University of Medicine and Pharmacy “Victor Babes” from Timisoara found caudate branches of the PHV having different origin. This paper analyses and standardizes the morphological types of intra-parenchymal spatial distribution of these branches, considering all their points of origin. The study material was represented by 100 hepatic corrosion casts. They were made by injecting with plastic (paste AGO II and TECHNOVIT 7143) of the vasculo-ductal system, followed by parenchyma corrosion with hydrochloric acid. On the study material we found 297 caudate branches of the PHV, having their origin in: the PHV trunk (0.33%), the PHV bifurcation (1.35%), the left branch of PHV (89.23%), the right branch of PHV (5.39%), the anterior branch (3.37%) and the posterior branch (0.33%). In order to study some of the morphological factors that favor the PHV caudate branches with peculiar origins, we analyzed the branching modalities of the PHV trunk. In 97% cases we found the modal type, with the bifurcation of the trunk into the left branch and the right branch; in 3% cases we found the trifurcation of the PHV trunk into the left branch, the anterior branch and the posterior branch. We found 15 morphological types of origin of the PHV caudate branches, with the number of portal caudate branches varying between 1 and 6. In 11% casts we found one caudate branch, in 32% - 2 caudate branches, in 18% casts – 3 caudate branches, in 29% - 4 caudate branches, in 8% - 5 caudate branches, and in 2% cases – 6 caudate branches. In 65% cases we found caudate branches originating only in the left branch of the PHV. The trifurcation of the PHV trunk leads to peculiar origins of the caudate branches (from the anterior branch, the posterior branch, the bifurcation and the trunk). Knowing the peculiar origins of the caudate branches of PHV is very useful for the surgeons performing liver resections. (Supported by CNMP 4.1-092/2007)

Modalities of branching of the vascular elements of liver’s afferent pedicle. study on corrosion casts. ***Matusz PL, AM Pusztai***. *University of Medicine and Pharmacy "Victor Babes", Timisoara, Romania.*

Liver’s vascular elements of the afferent pedicle are the portal hepatic vein (PHV) and the proper hepatic artery (PHA). They are accompanied by elements of the biliary ducts system. Branching of the vascular elements in the superior portion of the hepatic pedicle presents morphological aspects with surgical significance. This paper analyses the branching modalities of PHV and PHA trunks on one side, and on the other side the peculiar morphologic relationship of the branching vascular elements. The study material consisted of 100 liver corrosion casts. They were made by injecting with plastic (AGO II paste and TECHNOVIT 7143) of the vasculo-ductal systems, followed by hepatic parenchyma corrosion with hydrochloric acid. PHV presents 3 morphological types of branching. In 97% cases the PHV trunk forks into the

right branch (RB) and the left branch (LB). In turn, RB forks into the anterior branch (ABr) and the posterior branch (PBr); LB gives birth to lateral branches (LBr) and to medial branches (MBr), from the umbilical portion. In 2% cases the PHV trunk trifurcates into: LB, ABr and PBr. In 1% cases the PHV trunk bifurcates into LB and PBr, with ABr starting from the transverse portion of the LB. RB and LB of the PHA were analyzed separately, according to the branching modalities. Thus, RB gives birth, in 84% cases, to the anterior branch (ABr) and to the posterior branch (PBr); in 5% cases it continues only with PBr; and in 11% cases it gives birth to 3 branches: ABr, Pbr and the medial branch (MBr), which crosses the plane of the main portal fissure. LB gives birth, in 87% cases, to LBr and MBr; in 13% cases it continues only with LBr. By analyzing the variability of branching of liver's afferent vascular elements we notice that PHV presents a modal aspect in 97% cases (with 3% variability). PHA presents a modal aspect in 74% cases (with 26% variability). The aspects of variability of PHV were accompanied by the modal distribution of the PHA branches. Only in one case the origin of MBr of PHA from the RB was associated with a major variant of branching of PHV trunk (trunk trifurcation into LB, ABr and PBr). These morphological aspects are very useful for surgeons when planning liver resection and transplant surgery.