ABSTRACTS
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A BRIEF CHRONOLOGY OF PLASTINATION
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I suspect that there is no single "Birthday" for Plastination. The one we celebrate at this meeting is actually a good estimate that establishes a date at which Plastination has gained a little momentum and something of an identity -- but, like most other important things, Plastination developed gradually from a concept.

As most of you know, it was the brainchild of Gunther von Hagens, who one day decided that, instead of embedding a specimen in plastic, the plastic should be induced to enter the tissue and then cured, in situ. This led to the principle of forced impregnation and, after several years, to the technology, the International Society for Plastination and the meeting schedule we now enjoy. If I had to assign some kind of a date for its origin, I would suggest that the intellectual process leading to Plastination began sometime around the year, 1975 - but I would have to check with Gunther to be sure or more specific.

What we can date with assurance are the international meetings, so we will use these as an approach to our chronology.

PRINCIPLES OF PLASTINATION
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Plastination for preservation of biological specimens for teaching anatomy or pathology has been used to a limited extent for 20 years. Plastination was invented in Heidelberg, Germany, in 1975 by the physician, anatomist, Dr. Gunther von Hagens. Scattered throughout the world several institutions routinely use the process and a few specimens are available commercially. Plastinated specimens are clean, dry and free from irritating formaldehyde vapors. They are esthetically pleasing to students and offer a convenient mode for reviewing anatomy. In brief, plastination is the process of replacing fluid in a specimen with a curable polymer.

The polymers must possess the desired properties to produce the type specimen desired. The first step is **1. Specimen preparation:** the specimen must first be prepared for the format that you wish for presentation (whole or slices). This may include fixation or not. **2. Dehydration:** After any fixative is removed by running tap water, tissue fluid must be removed in preparation for introduction of a polymer into the tissue. Cold acetone has emerged as the classic dehydrating agent. However, a graded alcohol series has merit and room temperature acetone is currently being evaluated. 3. **Volatile intermediary solvent:** Once the specimen is dehydrated, the dehydrating fluid must be replaced with a solvent which can be exchanged for the polymer. This solvent's boiling point must be sufficiently different from the polymer so that the solvent can be extracted from the specimen. As the solvent is extracted, a void is created in the tissue which will allow the polymer to move into the tissue void. Acetone has these properties as does methylene chloride (dichloromethane). Therefore, using acetone for dehydration has already completed this step. **4. Impregnation:** Is the act of boiling off the solvent from the specimen which allows the polymer to enter the tissue void. This is accomplished by decreasing pressure to the point where the intermediary solvent boils out of the specimen and is extracted from the vacuum chamber in the exhaust of the vacuum pump. [Acetone: 55cm/ 22in CTA, 40cm/16in RTA; Dichloromethane: 45cm/18in CTM or 33cm/13in RTM]. The polymer enters the specimen over a period of 24 hours to days depending on the thickness of the specimen. **5. Polymerization (hardening):** A activator or crosslinker is exposed to the polymer filled specimen to cause the polymer to polymerize and stay inside the specimen. Upon completion, the specimen is forever preserved.

CURRENT TOPICS ON DEHYDRATION
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Dehydration for plastination has classically utilized cold (-20°C) acetone. And rightly so! Cold acetone has yielded excellent silicone impregnated specimens for two decades. One of its superior qualities is minimalization of shrinkage, especially in nervous tissue. However, acetone is often under close scrutiny by governmental safety officers and occasionally its regulation is a deterrent to establishing a plastination laboratory. Recent claims by new polymer providers for plastination have advocated room temperature acetone dehydration, which may be a more hazardous situation. Their claims are faster dehydration, decreased color loss and increased flexibility. This directed our group's focus toward an investigation of how good is room temperature ac-

etone for dehydration! Or what are the problems associated with each dehydrating agent and are there other dehydrants that may have equally good properties? Our preliminary results indicate only an average of 2.5% increase in shrinkage of tissues dehydrated in room temperature acetone when compared to those dehydrated in cold (-20°C) acetone. Our specimens have not been impregnated at this time but those results will be presented at the meeting. Alcohol dehydration results will also be presented at that time.

PRINCIPLES OF SILICONE PLASTINATION

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Silicone specimens provide an excellent means for preservation and presentation of any anatomical, pathological or biological specimens. Especially, difficult to understand regional anatomy can be prosected and preserved by silicone plastination and presented to medical students. Wet and often under used formaldehyde or alcohol entombed museum specimens can be transformed into user friendly learning aids. Silicone body slices are excellent adjuncts for studying sectional anatomy and for correlation with ultrasonographic, CT or MRI scans. Use of the plastination method has waxed and waned.

One reason often given for not plastinating is the expense of the process and particularly that of the polymers. On the contrary, we have found that the polymers are one of the least expensive components. In the average specimen, only 0.4 kg of polymer is used per kilogram of finished specimen. At current silicone prices ($35 to $48/kg, $16 to 22$/lb), polymer cost per kilogram of specimen is only $17. The majority of the cost of plastinating is the time spent in specimen preparation and laboratory costs (space and equipment). However, as has been presented so eloquently in the past, space and equipment costs can be minimal. What is really needed is a person dedicated to the process. Silicone plastination is a unique process which should be considered for preserving biological specimens for the 21st century.

Specimen preparation: is by far the most critical step. Specimens must be produced to clearly delineate the morphology. Once the specimen is fixed and dehydrated, it is difficult to alter its appearance. Cavities must be dilated, flexures must be fixed in place and extraneous connective tissue removed. Fixation generally should be minimal to none.

Dehydration: Cold acetone has emerged as the most reliable. A graded series of alcohol is fine and warm acetone is being used. Cold acetone is generally believed to reduce shrinkage. Care must be taken to have the specimen in correct anatomical position during dehydration.

Intermediary solvent: Acetone is one of the two recommended solvents. Logically if it was the dehydrant, once dehydrated the specimen is ready for impregnation. However, if alcohol was used, the alcohol must be exchanged for acetone or methylene chloride (dichloromethane). The advantage of methylene chloride is its great affinity for lipid and hence its rapid thorough removal of fat.

Impregnation: Classically impregnation has been in a deep freezer at -15°C. The Biodur silicone can be impregnated at room temperature, but is preferable in the cold because the impregnation mix contains an activator and chain extender which commences the thickening (curing) reaction at room temperature. New room temperature silicones which are stable at room temperature are currently being introduced. The necessary activators are not mixed into the impregnation mixture but added after the impregnation mixture is within the specimen.

Polymerization (Curing): Many terms are used for making the polymer change from a liquid to a dry state (polymerize, harden, cure, cross link, activate). Obviously this must occur after the polymer has been impregnated into the specimen. Again it is important to have the specimen in correct anatomical position while the polymer is hardening. Once the specimen has cured, it is preserved forever.

THE S6-GASHARDENING UNIT WITH COMPRESSED AIR

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The S6-gashardening unit with compressed air for the hardening of Biodur S10/S15-impregnated specimens is arranged into 3 segments: First in a dripping area, second the actual gashardening with 3 large sized plastic tubs, than an ample area with the regulation-valves of the compressed air supply and a chest for the glass flask of the Biodur S6 gashardener. In the chest there is also a glass cylinder for the secretion of fluid gashardener and the switch-gear for the ventilation. To concentrate the atmosphere with gashardener in the inside of the hardener tubs we used water-free compressed laboratory air. The air is flowing over a glass flask, filled with gashardener - and enriched with it - lead over a copper-pipe-system to the specific tubs. The tubs are connected to each other with flexible aluminum tubes for better circulation of the air. In addition two ventilators are serving for an optimal dispersion of hardener gas into the tubs. A separate pressure air conducting with a reduction-valve connected in series are serving for the hardening of hollow organs in their natural shape. This gashardening unit make possible the curing of a large number of specimens within 3 to 14 days.

PLASTINATION AT ROOM TEMPERATURE

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In the standard plastination procedure, originally developed and described by von Hagens, the dehydration by freeze substitution in acetone and the forced impregnation of the specimens are normally achieved at -25°C in a deep freezer. Now, we have been able to develop a procedure that successfully allows these steps to be carried out at room temperature (15 - 20°C). We have also developed an intermittent vacuum procedure that replaces the continue vacuum procedure described by von Hagens. The use of a new type of silicone named the Su-Yi Chinese silicone developed in 1996 permits this plastination procedure at room temperature.

These improvements reduce capital costs (expensive spark proof deep-freezer) and improve safety by reducing the risk of explosion that acetone vapour could generate in an enclosed space. The intermittent vacuum procedure also reduces capital costs of high quality vacuum pump. Many large and small high quality gross anatomical specimens have been prepared in this way. They have remained in good condition and retained stable color. The surfaces are dry and show no oozing of remnant silicone.

The Su-Yi Chinese silicone is cheaper than the Biodur silicone developed by von Hagens and now not only being used in some universities in China but also in the University of Hong Kong.

SHEET PLASTINATION, E12 TECHNIQUE, FILLING METHOD. LECTURE / BENCH TOP DEMONSTRATION

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Plastination of thin whole body or organ slices with E12 epoxy resin yields transparent or opaque specimens that are in particular useful for teaching cross sectional aspects of the anatomy as they appear in cat scans and similar diagnostic images. The lecture describes and demonstrates the key steps of this technique: fixation of the specimen may be omitted. Dilating of the vessels prior to freezing the specimen is advised. The blade speed of the saw, some modifications regarding the portion fence and the type of saw blade selected have major influence on the quality of the surface of the slices. The slices are stacked in packages for easier handling in the freeze substitution, degreasing and forced impregnation steps. A bench top demonstration visualizes the assembly of a "flat chamber" casting mold, filling the mold with resin, and manipulating the specimens and air bubbles inside the mold. The flat chambers are placed at a slight incline at room temperature for initial curing and later transferred to a 40°C environment for final curing. The cured sheet is released by dismantling the mold and the singular slices are cut out by means of a band saw or scroll saw. The rough edges on the slices can be smoothed over with a drum sander, wet grindstone or similar abrasive tool. A final warm water bath will both clean the surfaces from dust and relieve tensions imparted by factional heat when cutting and sanding the slices. The draining method - a variation of the filling method - can be used if a smooth surface of the final product is not required or to reduce the cost of the production. Specimens produced with the draining method are suitable for embedding in E12 resin to give them the same appearance as specimens produced with the filling method.

SUBMACROSCOPIC INTERPRETATION OF HUMAN SECTIONAL ANATOMY USING PLASTINATED E12 SECTIONS

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The E12 epoxy method of sheet plastination for preparing transparent and serially sectioned cadaveric teaching specimens has for the most part seen the finished sections utilised in the correlation of MRI and CT radiographic images. The unique properties of the E12 process offer an exceptionally vivid survey of the human body in any given plane resulting in precise delineation of the structural layout *in situ.* Maximum detail of the sections is attained by way of transparency through large scale lipid extraction producing easily discernible details of anatomical structures within a gross specimen.

Sections were prepared in sagittal, horizontal and coronal planes from different regions of the body including head and neck, trunk, inguinal region, limbs and joints. The macroscopic structures within these sections correspond precisely with images of the same structures obtained radiologically.

By introducing E12 sectional anatomy specimens to the anatomy teaching laboratory, the transition between gross anatomy and histology has been made possible by studying the one specimen. When utilised in our combined topographic anatomy and histology teaching laboratories, anatomical structures of thin and transparent slices can be magnified considerably. Standard histological slides providing detail of a specific structure within predetermined parameters, are often dictated by the physical limitations of the microscope slide itself. E12 sections provide a high degree of detail whilst retaining *in situ* structural integrity of the entire region in a complete and uninterrupted state.

Students are provided with significant detail of all components to the submacroscopic level from any one specimen

thus linking the three disciplines, namely cross-sectional anatomy, radiology and histology using a single E12 slice. E12 plastinated sections have been recognised as an ideal teaching aid in conjunction with radiological correlation, but it is in the microscopy laboratory that a valuable new dimension of this multi-disciplinary plastination technique has recently been realised.

THE TISSUE LAYERS OF PLASTINATED SECTIONS COMPARED WITH TISSUE LAYERS OF CLINICAL IMAGES

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The structural arrangement of the human body is shown in clear detail by plastinated multiplane sections. Each region and each organ show, in adequate high quality sections, layers. These layers can be seen in both cadaver plastinated sections and clinical images. In fact, this should be one evaluative criteria used in the quality control of plastinated sections and clinical images. The better the layers are differenciated by the method or device used to prepare the section the better the quality and usefulness of the sections for study and interpretation.

Four classes of tissue layers in this study are recognized which include: 1) Somatic tissue layers; 2) Extravisceral (visceral) layers; 3) Intravisceral luminar layers and 4) Intravisceral nonluminar layers. An example of somatic layers are those formed from the somatopleure. The tissue layers of the body wall of major cavities arise from the somatopleure. Examples of the other three layer systems include organs derived from splanchnopleure. The extravisceral (visceral) means the arrangement of these viscera within the major body cavities. Intravisceral luminar organ refer to those layers of hollow organs derived from the splanchnopleure and intravisceral nonluminar layers involves organs without lumen such as adrenal glands and kidneys.

One or more of each class is illustrated and compared using sectional plastinated specimen and clinical images.

SHEET PLASTINATION OF BRAIN SLICES ACCORDING TO THE P35 AND P40 PROCEDURES

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Introduction

For the plastination of brain slices the P35 or P40 procedures are recommended. These procedures result in thin (2,4,6, or 8 mm) and semitransparent slices.

P35 procedure

1) Fixation: Fresh brain specimens are fixed the usual way with 10 % formaldehyde. Old wet specimen should not be used for the P-35 procedure, because fixatives other than formaldehyde may cause unintentional reactions with the polymer.

2) Slicing: The fixed brains are sliced with a meat sheer into 4 mm (or 6 or 8 mm) thick slices. To prevent degrada tion of the slices wet filter paper is trimmed to the size of the brain and placed on top of the brain slice before slicing. Also gelatin embedding of the formalin fixed brains can be used to keep pieces together during slicing. The slices are placed on a stainless steel grid and the grids are piled up in a stain less steel basket.

3) Flushing and precooling: The basket of brain slices is rinsed with cold tap water overnight and cooled down to 5°C.

4a) 1 st Dehydration: The basket of flushed and precooled brain slices is submerged in 100% acetone at -20°C (251 per brain) for 1 - 2 days.

4b)2nd Dehydration: The basket of brain slices is submerged in another bath of 100% acetone at -20°C (25 1 per brain) for another 1-2 days. Dehydration is checked by an acetonometer and must reach at least 98 %.

5a)lst Immersion: The basket of dehydrated brain slices is submerged in a precooled P35 - A9 mixture (100:2) for one day at 5°C (to -25°C).This bath must be discarded after use.

5b)2nd Immersion: (This step may be omitted when using a fresh 1 st immersion mixture). The basket of brain slices is submerged in fresh P35 - A9 mixture (100:2) for one more day at 5°C. This bath might be used as 1st immersion bath for the next procedure.

5c)Forced impregnation: Once more the basket of brain slices is submerged in a fresh P35 - A9 mixture (100:2) and exposed to vacuum for 24 hours at - 25°C (or at room temperature). The vacuum is increased down to 10 -15 mm Hg. This bath may be used as 2nd immerion bath for the next procedure.

6)Casting / double glass chambers: The slices are removed from the vaccum chamber and each single slice is placed between two sheets of glass plates. Each sheet consists of one safety glass plate and one float glass plate, the latter facing the brain slices. A silicone gasket is used to seal the chamber around the edges and fold-back clamps are used to fix the two double glass plates together. Then the double glass chambers are filled with a fresh P35 - A9 mixture (700 cc for a 35 x 45 cm standard size chamber). Air bubbles are removed either by exposing the double glass chambers to vacuum for a short time (approx. 1 hour) or by heating them in the heat cabinet for a short time (approx. 1 hour). Finally the double glass chambers are turned to an almost horizontal position. Then the slices are arranged in the desired position either by use of steel wire or by use of small steel balls inside the chamber, that can be moved by a magnet outside the chamber.

7a)Light Curing: After casting the double glass cham-

bers are exposed to UVA-light for 45 minutes to 4 hours depending on the watts and on the distance of the UVA-lamps. During this procedure it is necessary to cool the chambers either by ventilators or by blowing compressed air over both sides of the double glass chamber.

7b)Heat Curing: After light curing the double glass chambers are exposed to 45°C for 4-5 days in a well-ventilated oven.

8)Finishing: After curing is finished the slices are dismantled, trimmed by a band saw, the edges smoothened using a belt sander, and the surface polished using car polish.

P40 procedure

The P40 procedure has some remarkable advantages, particularly this procedure is faster and cheaper compared to the P35 procedure.

The advantages are:

The same polymer is used for immersion, impregnation, and filling of the chambers (steps 5 and 6).

Only single float glass chambers are necessary instead of the expensive double glass chambers with safety glass (step 6).

P40 does not cure with heat and is cured by UVA-light only. Thus, no expensive ventilated heat cabinet is needed (step 7).

P40 can also be used for transparent body slices and thus enables us to produce transparent head slices with the brain in situ.

There are, however, some remarkable disadvantages:

P40 is a ready-mix polymer, i.e. the hardener is already in the polymer. This results in a relatively shorter shelf-live.

P40 is much more sensitive to even smaller changes in the protocol. Particularly the light curing step caused many troubles within the last years. Too fast curing, caused by high watt lamps, too short distance between lamp and glass chamber, and insufficient cooling during light curing resulted in orange spots, that ruined the final specimen.

Thus, it is still recommendable to prefer the P35 procedure especially for beginners.

UPDATE ON POLYESTER PLASTINATION (P40)! WHERE HAVE ALL THE "ORANGE SPOTS" GONE?

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P40 (polyester) sheet plastination of brain slices was commenced at the University of Tennessee one and one half years ago. Our first groups of specimens were quite unique but held to The University of Tennessee color tradition, "Orange and White". The gray matter had consolidations of orange color. Even though we had tried to follow the protocol to the letter. Of course, demonstrations often do not go as expected and the 1997 plastination workshop could only produce such brain slices. However, since the close of the workshop, we can not produce orange gray matter. What did we do wrong? 1. Slices were cut with a brain knife and were at least 6mm and not of uniform thickness. 2. Impregnation was apparently not complete. 3. Temperature was monitored only by digital touch. When the areas of the brain slice with orange spots were opened, they appeared dry and flaky. This would seem to indicate that acetone was not entirely extracted and thus P40 had never reached the depths of the cellular gray matter. Since using a mechanical slicer (which was used to produce 2 & 3 mm uniform slices) and making sure that impregnation was complete (all acetone extracted), we have had perfect slices using only UV light as the curing agent. We have also used a chemical activator with similar success.

ADAPTING THE P35 PLASTINATION PROTOCOL FOR BRAIN STEM THIN SECTIONS

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Sheet plastination offers an ideal medium for presenting neural structure visually. However, the use of a standard 4 mm section-thickness that works well in depicting anatomy of the forebrain loses resolution when applied to the smaller dimensions of brain stem or spinal cord sub-structure. A pilot project was undertaken to devise a simple method for producing sections sufficiently thin to present finer detail while, at the same time, being thick enough to demonstrate inherent structural contrast.

A B&L sledge microtome was modified by replacing the blade-holder with a plexiglas stage having a centered 3 cm aperture. A segment of brain stem or spinal cord, frozen at -40°C, is mounted on a plywood block chucked in the specimen holder. The specimen, then, is advanced a critical distance through the stage aperture to be sectioned with a straight razor at a thickness ranging from approximately 120 to 200 micrometers. The thinness of the blade together with the shearing nature of the incision minimize compression fracture in the specimen.

The plastination procedure used (freeze substitution followed by vacuum infiltration) and mounting on a glass slide under a coverglass is adapted closely from the standard protocol.

This procedure provides a relatively quick and economical way in which to prepare either experimental or instructional material for review under low magnification.

PLASTINATION OF THREE DIMENSIONAL STRUCTURES WITH P40

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This study intends to present a new aspect in plastination with P40, not only in processing brain slices, but also in plastination of three dimensional structures. We thought that working with nervous tissues would make the modification of the P40 plastination process easier, so decided to plastinate a human brachial plexus and a dissected human brain. The plexus was removed from a fixed body, from the dissection room. The brain was obtained fresh from an individual who had donated his body to the Institute of Anatomy. The brain was fixed in 5 % formalin solution for three months. After dehydration both specimens were immersed and impregnated with P40. The main problem in curing P40 is that it should be done under UV-light and in a closed, airless chamber, otherwise the surface of the plastinated specimen remains sticky. Curing was therefore performed by using UV-light and simultaneously keeping the specimen under vacuum.

P40 PLASTINATION OF HUMAN BRAIN SLICES: COMPARISON BETWEEN DIFFERENT IMMERSION AND IMPREGNATION CONDITIONS

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Human sagittal slices, 4 mm thick, were plastinated with P40 using different immersion and impregnation conditions. Both brain halves were sliced. From each brain half we selected 8 slices. Two points were marked on each slice and subsequently an imprint of the slices was drawn on transparency film. After dehydration in -25°C acetone, the slices of the left brain half were immersed at -25°C for two days and impregnated 24 hours, the slices of the right brain half were immersed at +5°C for two days and impregnated at room temperature at + 15°C for 24 hours. All impregnated slices were plastinated. The imprints of the brain slices were scanned in computer, as well as the plastinated slices. By using a Kontron KSA400 v. 2.0 (ZEISS) software we calculated the area of the plastinated brain slices as well as the area of the scanned imprints. Comparing the obtained data we were able to determine the shrinkage rate of the slices. The slices processed at -25°C showed a shrinkage rate of 4.47% . In comparison the slices immersed at +5°C and impregnated at +15°C showed a shrinkage rate of 6.95%.

A COMPARATIVE STUDY OF THREE POLYESTER POLYMERS FOR PLASTINATION OF THIN HUMAN BRAIN SLICES

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The goal of this study was to compare two polyester polymers [Caroplastic (Carolina Biological Supply) and Bio-Plastic (Ward's Natural Science)] with P35 (Biodur) used for plastination of human brain slices. For every type of polymers used, the basic procedures where the same. We wanted to emphasize on the principal advantages and disadvantages of each products in two aspects, that is to say, financial cost and also the quality of the plastinated specimen obtained. The brains were obtained from cadavers fixed for dissection. They were embedded in gelatin, sliced and kept in 10% formalin at 4°C for about one year. After fixation they were rinsed with cold water and dehydrated with 100% acetone at -25°C. Next, the slices were immersed twice, impregnated and casted in glass molds. Our preliminary results suggest that the three polymers lead to brain slices that show a similar color differentiation between gray and white matter.

AN ECONOMICAL PLASTINATION PILOT PROJECT AND TRIAL OF THE COR-PR-10 POLYMER

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For some time we have been interested in plastination. With the support of the Chair of Anatomy, Dr. Cramer, in 1996 I joined the International Society for Plastination and actively explored literature about the procedure. In late 1997 our initial proposed US$3000 budget for an inexpensive pilot plastination laboratory was not able to be funded. So we began anyway. We had no budget and no experience, but had enthusiasm and great help from many experienced plastinators. An existing, broken but functioning, household countertop refrigerator was modified extensively to incorporate a vacuum manifold and produce low temperatures. I rebuilt one vacuum pump from two old nonfunctioning l/2hp Gast vacuum pumps which I discovered in our clinic machine room. Our vacuum chamber is a stainless steel four quart pressure cooker (Presto) with a 3/8 inch Lexan cover. We began in a temporary room which has a piped roof vent for the pump acetone exhaust. We wanted to try the new COR-PR-10 polymer from Corcoran Laboratories Inc., so for the first trial we planned a broad range of specimens: a lumbar parasagittal section, a half kidney, a gall bladder, a section of pancreas, wrist carpal bones, a small piece of

muscle, and a small portion of brain. A description of our apparatus, procedures and results will be presented.

A STUDY ON PRESERVATION OF ANCIENT CORPSES USING THE TECHNIQUE OF PLASTINATION

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Using the technique of plastination, through fixation, dehydration, forced impregnation and curing, two ancient corpses died 400 years ago have been successfully plastinated. All the plastination procedure was carried out at room temperature (20°C). We also used the intermittent vacuum procedure and the Su-Yi Chinese silicone. After plastination the ancient corpses retained their original shape but weight has increased. The colors of the ancient corpses are much better than before plastination. The soft tissues remained flexible and the specimens presented no smell and no toxicity. The surfaces are dry, present no oozing of remnant silicone and can be touched by bare hands. The ancient corpses can now be preserved easily for long time without special care.

During the histological study performed before and after plastination, we found some red cells in the lung tissue of one of the ancient corpses. The morphology of these 400 years old red cells has been preserved as fresh ones.

PLASTINATION AND CEREBELLOPONTINE ANGLE

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The plastination is a new and recent method of preservation of anatomical specimens. It involves the extraction of the water and fat, which are replaced by a polymer in the organic tissues. The authors have determined a protocol of plastination of the cerebello-pontine angle. Five specimens were prepared by the retrolabyrinthine approach, four have received a coloured arterial injection, three have benefited from a superior approach after ablation of the cerebral hemisphere and the tentorium cerebelli. The plastination shows its potential in the preservation of the specimens which can be examined at any time without particular precaution.The examination of the anatomical relations is exceptional. The plastination technique offers educational possibilities unknown until this day which have a great importance for surgical practice and training.

ASSESSING THE FEASIBILITY OF USING PLASTINATED HUMAN SPECIMENS IN THE TEACHING OF RADIOLOGY

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Our goal was to demonstrate whether plastinated human tissue specimens could be used successfully as radiology phantoms. Phantoms are used to teach radiology techniques, including positioning and parameter setting. Plastinated specimens could possibly be used, at a fraction of the cost of a commercially produced phantom.

Two knees obtained from the same cadaver were used, and a classic phantom was used to allow for comparison. We used a typical plastination technique, with fixation by immersion, freeze substitution in acetone, impregnation with silicone S10 and fast curing. Both knees were x-rayed after each step of the process, beginning with the fresh specimens and ending with the final plastinated specimens. The x-ray parameters used were identical for each step.

The preliminary results demonstrate that the plastinated knees could be used to teach radiology positioning. Nevertheless, a better quality has to be obtained if the specimens are to be used as resources to teach parameter setting or for other purposes, were image quality is of importance. We are pursuing research to obtain plastinated specimens better suited for these purposes.

AN EDUCATIONAL COMPARISON OF THIN PLASTINATED CADAVERIC SECTIONS AND MAGNETIC RESONANCE IMAGES

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The revolution in diagnostic imaging has necessitated a return in the teaching of cross-sectional anatomy. It is clinically important that anatomy students of all disciplines, as well as physicians and medical technologists, understand the three-dimensional structural relationships of the body. The relatively new technique of plastination first described by von Hagens in 1979 is believed to be a valuable method for the production of highly instructive thin cross-sections. Plastination involves the impregnation of perishable biological specimens with a curable polymer. Several variations of this technique are available, depending on both the type of specimen and polymer being used. In this study, the effectiveness of BIODUR® PEM 11 prepared cross-sections and magnetic resonance images (MRIs) as teaching aides for sectional anatomy was investigated.

Three human cadaveric heads were scanned on a magnetic resonance (MR) imager. Coronal, transverse and sagittal slices, ~6 mm in thickness, were recorded. Correspond-

ing slices of cadaveric head were cut in each plane and plastinated by the BIODUR® PEM 11 method. In general, a good correlation existed between the plastinated sections and the MR scans. Additionally, the plastinated sections displayed an excellent differentiation between all tissue types. Hence, the PEM 11 technique is a viable alternative to plastination by other methods.

The efficacy of the two modalities as teaching tools was evaluated by testing 45 students studying head and neck anatomy. The students were divided into 3 groups, with each group using a different medium for testing (ie. plastinated section only, MRI only or corresponding section and scan together). The existing anatomical knowledge of each group was pre-tested using numerically labelled specimens. A 40 minute "study" period enabled the students to revise the topographical arrangement of labelled features in their specimen. Following this, each group completed a post-test using a corresponding MRI and plastinated section.

A series of statistical analysis of variance tests were performed on the results. It was shown that no significant difference existed in the mean scores between the 3 teaching procedures. Therefore, MRIs and plastinated sections are equally effective as tools for learning cross-sectional anatomy.

ELABORATION OF A THREE-DIMENSIONAL IDENTIFICATION KEY FOR MICROCHEIROPTERANS SPECIES OF QUEBEC WITH THE S10 PLASTINATION TECHNIQUE

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This study aims at conceiving a three-dimensional identification key for bats found in the province of Quebec. These are the first results obtained from experiments carried on seven (7) different specimens of cave-bats (5 *Myotis lucifugus* and 2 *Myotis septentrionalis*). The main challenge of this research is to obtain, through the use of plastination, specimens perfectly conserved so that all the morphological criteria used for identification can be easily found and in accordance with the species. Moreover, to accelerate the process, we relied on two techniques of dehydration (freeze-drying and freeze substitution in acetone) and are trying to develop a useful technique in rendering a natural aspect to the body and by keeping the fur free of silicone during the curing. The analysis of the results, which were obtained and presented during this conference, will serve to develop a unique plastination technique useful for microcheiropterans and the final results should be available by December 1998.

THE USE OF S-10 PLASTINATED SPINES FOR RADIOLOGY TEACHING

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The purpose of this study is to add a new perspective to the usual methods and approaches in teaching radiology.

We took the cadavers that had been dissected by the chiropractic students and radiographed them to search for abnormalities.

After evaluating the x-ray, we selected the specimens with pathology and plastinated them according to the S-10 method which gave a very satisfying result. It helped visualize, in 3-D, what was perceived in the x-ray.

Plastination and radiology combined, is a very useful tool for diagnostic purposes. A survey among teachers, clinicians, 4th and 5th year chiropractic students allowed us to evaluate plastination relevance to radiology education.

HUMAN BRAIN AND SPINAL CORD WITH NERVE PLEXUSES DEMONSTRATED BY THE S10 TECHNIQUE

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The purpose of this paper is to outline a process of producing 3D-models of human brain and spinal cord along with neural plexuses demonstration. For preparation, the cadaver was fixed. During the dissection, we tried to save most of the peripheral nerves.

After removal of the calvaria and the brain, dissection of the spinal cord was begun from the upper end of the vertebral column to its lower part. Plexuses and nerves were dissected from their proximal to their distal ends. Dehydration was performed by the freeze substitution method. Specimens were immerged in a mixture of S10/S3 (100:1) for three days and then forced impregnated at -25°C during three weeks. The pressure was slowly decreased down to 4 mm of Hg. After removing of the excess of polymer from the specimens surfaces, they were fixed on a PVC board with needles and procured for eight weeks. They were after covered with plastic and gas cured.

S10 plastinated brains and spinal cords provide a good pedagogical instrument. They can also be used by the students to help the understanding of the three dimensional concept of neurological structures. They can be used to teach neuroanatomy to medical students, neurologists, physiotherapists as well as nurses.

PLASTINATED SPECIMENS FOR FURTHER DISSECTIONS

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After fixation and dehydration, two forearms with hands and two legs with feet were placed into the Su-Yi Chinese silicone for intermittent forced impregnation during 20 days. After this impregnation, these specimens were taken from the vacuum chamber, drained from the excess silicone and wiped. They are soft, still flexible and can be dissected just as fixed specimens.

The main characteristic of the present technique is that these plastinated specimens present no smell and no toxicity. The dissector can concentrate on his dissecting work and enjoy teaching and dissecting. During the dissecting procedure every step can be done easily. The skin can be cut, fat can be removed and the fascia and muscles can also be easily separated. The blood vessels and nerves are much stronger and much more easily separated from other structure. So you can take the plastinated specimens to make dissection more convenient, more effective and prepare perfectly dissected works. After the dissection you can cure these specimens.

These plastinated specimens can be preserved in a plastic bag. They can be stored in this way for 10 to 12 months or more before being cured.

A NEW TECHNIQUE FOR EMBALMING AND PRESERVING CORPSES

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The Department of Anatomy of the Complutense University of Madrid, under the supervision of Prof. Dr. Jimenez-Collado, has conducted a series of research projects over the last few years, whose results are of vital importance for thanatologist, forensic and public medicolegal officers, coroners and anatomists. Prof. Dr. Arene former head of the Department of Anatomy at San Andre's Central University, Bolivia, is acknowledge to have made essential contributions in the course of this research. The product is based on a new concept regarding the techniques of embalming and preservation practiced to date and provides for a series of exceptional benefits, among which the following features should be highlighted. As a means of embalming organic tissue, the product solves the problem of contamination by microbiological agents, particularly fungi as the agents triggering corpse degradation. It was shown remarkably more efficient agent than other commercially available products, as regards the quality and the durability of the results obtained. Application of new product helps to repair the deformed anatomy, thus easing autopsy and necropsy. The same beneficial effects have been proven on mutilated corpses. Product application techniques are similar to the practice with conventional preservatives. On the other hand and very importantly, the developments allows to dispense with the use of formaldehyde for good and hence to avoid the problems inherent in this chemical, above all that of health hazard for the operators handling the product and the consequential labor incidents. This scientific finding has been patented and registered under the trade name Complucad®.

PRESERVATION TECHNIQUES IN EGYPT: SPECIAL CONSIDERATIONS

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There are many methods of preservation used in Egypt. They vary depending on the departments where they are used and on the utilization of the preserved specimen.

In Egypt, preservation of specimens and bodies began more than 5000 years ago when the ancient Egyptians invented the technique of mummification. Since years, many Egyptian and international scientists are studying mummification but have not yet succeed to understand it completely. They are also trying to know how these peoples were so great as they wanted to preserve their bodies and use them in a second life.

SPECIAL TECHNIQUE OF VASCULAR INJECTION AND CASTING: A MODEL TO STUDY THE PATTERNS OF SEGMENTAL ANATOMY OF LIVER

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Introduction: The vascular anatomy of the liver has been a topic of interest in the past and more so in this present age, where surgery on the liver has tremendously increased bringing in the necessity to know more about the anatomy of the liver. Segmental anatomy has been described by many scientists, but the most widely used and accepted by surgeons is the segmental anatomy based on the hepatic veins and the portal vein distribution in the liver. Carcinoma of the gall bladder is a common malignancy in Northern India. This malignancy is known to invade the liver either by direct infiltration or haematogenously at an early stage of the disease. Compared with gross dissection and radiological technique, the cast preparation appears to give a better display of intrahepatic anatomical relationship. The cast prepared by vascular injection may be of immense help in localizing and understanding various pathological processes and in planning the consequent surgical approach. Because of the conflicting accounts in the literature it has been decided to make

an exhaustive study of the anatomical/surgical segmentation of the liver by cast technique.

Material and Methods: The liver specimens were obtained from the autopsy room. These liver were taken from persons who have died due to RTA or suicide by hanging. 30 specimens were studied. PVC granules in 4 different colors, red, blue, green and white were used. PVC granules are normally used in plastic industry and first time has been tried for the preparation of vascular casts and standardized the technique. These granules were dissolved in acetone and an homogenous solution of optimum concentration was prepared. The different colored solution was injected in different vessels and casts were prepared.

Results: The vascular casts prepared with this material were of high quality and gives well defined delineation of hepatic segmentation. The study showed the marked variation in the sizes of segmentation.

ULTRASTRUCTURE OF THE TRACHEOBRONCHIAL EPITHELIUM OF THE NORMAL AND FORMALDEHYDE-EXPOSED GUINEA-PIG (A RESEARCH IN FAVOUR OF PLASTINATION)

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Formaldehyde has long been used as a preservative of cadavers in most of anatomy departments all over the world. The ultrastructural changes of the tracheobronchial epithelium of guinea pig after formaldehyde exposure included increased mucous secretion, epithelial desquamation, erosion, ulceration, thickening of the basement membrane and proliferative changes in the form of basal cell hyperplasia, squamous metaplasia, dysplasia and micropapillomatosis. The ciliated cells showed numerous changes including cloudy swelling of mitochondria, vacuolization of cytoplasm, dilatation of rough endoplasmic reticulum, chromatin margination and many ciliary changes. Three forms of ciliated cells changes were identified: (1) desquamation of intact cells, (2) rupture of the apical cells membrane and (3) ciliocytophthoria. The goblet cells underwent massive secretion of their contents and the mode of secretion was changed from merocrine to apocrine. Later on, goblet cell hyperplasia occured. New cells (tunnel cells) were observed after formaldehyde exposure. The presence of many submucosal undifferentiated cells raises the possibility of fibrosis and permanent airway obstruction as sequelae of long term exposure. The similarity between the lesions produced by formaldehyde and the early lesions occuring during carcinogenesis raises the possibility of carcinogenic effect of formaldehyde.

Assessment of formaldehyde carcinogenicity, teratogenicity and its effect on different parts of the body deserves further studies which are planned to be done in our department in the future. According to our results, we recommend the stoppage or at least minimizing usage of formaldehyde and the use of other safer available methods e.g. plastination.

BIODUR E20 EPOXY RESIN INJECTION OF THE PRESERVED GREYHOUND

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Biodur E20 epoxy resin was developed by Dr Gunther von Hagens in Heidelberg, Germany. E20 epoxy resin is used primarily as an injection medium to highlight the vascular system of plastinated specimens but can also be used to manufacture high quality corrosion casts. A greyhound was anaesthetised and exsanguinated via a carotid cannula. A 10% buffered formalin solution was perfused at a pressure of 7 lbs with the aid of an embalming tank. Perfusion ceased at saturation point. The injection of E20 resin was commenced approximately 12 to 24 hours after the completion of perfusion. Approximately 500 ml of red E20 epoxy resin was injected at a pressure of 5 lbs. Injection of E20 resin was judged to be complete when E20 resin was visible at the site of an incision made in a hindlimb footpad. The cadaver was sectioned into specimens prior to dissection. The final stage, plastination, was carried out according to the S10 procedure. The final result is a precise arterially injected anatomical teaching specimen.

COMPUTER PRESENTATION IN VASCULAR INJECTED SWINE HEART

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Using computer technique in education allows for a lot of data to be processed and presented in variety of ways. In this work we use scan photos from corrosion casts materials of the coronary circulation. Vascular injection materials of the left and the right coronary arteries are photographed and scanned on power point software. These specimens represent scientific examples, for anatomical study and comparative demonstrations. The technique is performed in ambient temperature by injecting liquid acrylic polymer (HH 772 Acrylic Casting and Embedding kit). The scans are adapted and presented in power point programs as slides. In this program, they are presented from different aspect for e.g. the anterior and the posterior side of the left and the right side of

the heart be seen separatly. On every single slide major branches of the right and the left coronary arteries and their anastomosis are marked.

For the presentation we need the following equipment: PC, CD-ROM and LCD projector (video beam). If this technique is implemented in the curriculum, the students would amass a computer-based collection of anatomical database. Generally speaking computers are more suited for this application than teaching materials like slides projectors, pictures or video tapes.

Computer-aided teaching programs are superior to other teaching programs due to the advantages that this media offers and should be used for the tasks such as animation, simulations, feedback, reference and searching, self-testing, revision, substitution for repetitive information given to small groups, etc.

PECULIARITIES OF THE BLOOD SUPPLY OF THE STERNOCLEIDOMASTOID MUSCLE DEMONSTRATED BY INJECTION OF COLOURED S-10

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Although the use of the sternocleidomastoid (SCM) muscle flap has a long tradition in plastic and reconstructive surgery of the head and neck the reliability of this technique is still doubted by some authors. This might at least partly be due to the fact that data dealing with the exact blood supply of this muscle are rare and confusing. In our last work we could show that the occipital, external carotid and suprascapular arteries send one or more branches into the SCM muscle. Yet, how much each of these arteries contributes to the blood supply of the whole SCM muscle remained to be determined. In 5 individuals who had donated their bodies to the Institute of Anatomy the occipital, external carotid and subclavian arteries were dissected free on both sides leaving the skin of the neck intact. After injection of three differently coloured mixtures of Silicon (S-10 Biodur) and Pintasol (Sandoz) into these three vessels the muscles were taken away together with a piece of the clavicle and sternum. Then they were made translucent using the Spalteholtz-technique. All muscles investigated were supplied by a branch of the suprascapular artery and one or two branches arising from the external carotid artery. In contradiction to common opinion among surgeons the occipital artery turned out to be the least important vessel for the blood supply of the SCM muscle. The findings presented suggest that more emphasis should be layed on the identification of the branches arising from the external carotid artery in order to further minimize the risk of flap necrosis. If the flap is based cranially and only one head of the muscle is shifted in the anterior region of the neck the branch arising from the suprascapular artery should be identified as well. Baring in mind these anatomical peculiarities the SCM muscle flap in our opinion represents a practicable and reliable alternative for plastic and reconstructive surgery of the head and neck.

PLASTINATION OF CAVIAR FISH WITH S10 TECHNIQUE IN IRAN: FIRST TRIALS

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In this paper, the complete procedure for caviar fish plastination with S10 will be stated. Fishes (weight 350-3000 g) were fixed in 5% formaldehyde. For dehydration, acetone at -25°C was used. Then, the fishes were immerged in a mixture of S10/S3 (100:1) for 24 hours. During the forced impregnation step, specimens were placed under vacuum at -25°C and pressure was decreased slowly down to 5 mm of Hg. Curing was done in two stages. In the precuring stage, the excess polymer was drained from the specimens surfaces and they were placed in an oven at 40°C for two days. In the gas curing stage, they were exposed to S6 vapors for 3 days at normal room temperature.

Compared with other techniques, such as taxidermy, plastination provided a better specimen. Due to the forced impregnation bath, the size of the specimens can be varied. One of its advantage is that we can plastinate the whole bodies of the fishes while retaining all the inner parts even viscera.

PREPARATION OF SPECIMENS ACCORDING TO THE E12 SHEET PLASTINATION METHOD

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The E12 plastination technique is a unique means to achieve precise human sectional anatomical specimens which correlate well with radiographic imaging techniques such as Magnetic Resonance Imaging and Computed Tomography. Sections are smooth, semi-transparent, durable and offer an unusually clear degree of anatomical details not often seen in traditional wet specimens or with other plastination methods such as S10, PEM or P35.

Whole cadavers or regions are cut into 2.5 mm thick sections. Sections are dehydrated, degreased and impregnated

according to standard plastination protocols.

Congruent overall thickness and finish is achieved by use of glass flat chambers. Impregnated sections are placed between two toughened glass plates which are secured with rubber gasket to prevent polymer leakage. The flat chamber is filled with epoxy polymer and catalyst enabling both surfaces of the encapsulated tissue section to be completely covered in curable polymer. Curing is initiated through low heat in a laboratory oven.

INFLUENCE OF FORMALDEHYDE/PHENOL FIXATION ON MRI OF THE KNEE AND CORRELATION WITH PLASTINATED SLICES

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Introduction: At the department of anatomy, students are taught using, amongst others, plastinated tissue. Due to a relative shortage and associated bio-hazards of working with fresh cadaver material, it would be beneficiary if embalmed material could be used. However, it is unknown how embalming affects MRI acquisition and its correlation with plastinated slices.

Materials and Methods: A fresh knee joint, dissected two hand widths above the knee, was obtained within 48 hours after death. Before, during (after 4 days) and after embalming MR (Tl and T2 weighted) images, of the same region of interest, were obtained. The MR images were later compared with sagittal plastinated slices.

Results: After embalming a distinct difference was visible on MR images. The contrast between different structures decreased due to a homogenisation of signal intensity.

Discussion: Although the quality of the MR images deteriorated as a result of embalming, it was still possible to evaluate the gross anatomical structures. Correlation with plastinated slices was also possible. Our results suggest that embalmed material can be used in correlation studies and for educational purposes. Although, further research into the effect of embalming on microstructures is necessary.

PLASTINATION AS TEACHING ASSISTANCE FOR PARAMEDICAL STUDENTS

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In the anatomical classroom, real human specimens are indispensable. However, in Japan, it is only the medical or dental school students who can have an anatomy education with dissecting real human bodies.

Therefore our students, in other paramedical courses, have dissected foetal pigs being sold on the market instead of dissecting real human bodies. They have to learn the differences between human body standing on the two feet and pig, a four-legged animal, moreover adult body structures and foetal ones. The foetal pig is about 20cm long (from the head to the hip), structures are very small, consequently students often destroy delicate structures such as the nervous system.

We prepared plastinated foetal pig bodies of some patterns, e.g. showing the nervous system, the muscle system and the abdominal viscera, the students who have failed to dissect delicate structures observe their specimens to understand what they have failed to do. And plastinated specimens help the students to get knowledge for the details of dissection.

PLASTINATION OF FISH AND LOBSTERS

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Both fish skin and the exoskeleton of the lobster are relatively impermeable. Plastination depends on the ability of formalin, acetone and polymer to move into the specimen and reach an equilibrium between the specimen and it's environment. Mechanical means have been used with success to make the fish skin and lobster exoskeleton more permeable: a fine gauge needle is used to prick holes into fish skin; a midventral incision in larger fish exposes the abdominal contents; small scalpel incisions are made into the soft tissue between joints in the lobster exoskeleton; small holes are drilled into the ends of the large lobster claws. To minimize shrinkage around the eyes some 20 % formalin is injected into the eye sockets. Following these initial mechanical disruptions standard S10 techniques is used. Fixatives include 5 to 10 % formalin or Klotz solution gradually made up to 6% over a period of several days. Dehydration occurs via freeze substitution in acetone. A relatively fresh and hence low viscosity S10/S3 solution is used for impregnation. Initial impregnation occurs at room temperature and atmospheric pressure (24 to 48 hours). This is followed by standard forced impregnation at -20°C and gas curing at room temperature. Swim bladders and cysts can be filled with S10/S3 supplemented with 2% S6. This will cure rapidly, maintaining the shape of the swim bladder or cyst. A variety of fish have been plastinated in this way as have whole and medially sectioned lobsters. The mechanical disruptions have minimal cosmetic effects on the final product and in fish minimize shrinkage in the susceptible areas (tail and back near dorsal fin).

MACROSCOPIC INTERPRETATION OF HORSE HEAD SECTIONAL ANATOMY USING PLASTINATED S10 SECTIONS

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Twenty four transversal sections of a horse head were plastinated in 1992 according to the standard S-10 technique in the Veterinary Anatomy laboratories, Murcia University, Spain. The sections, 1 cm thickness, lied from the first cervical vertebra to the medial angle of the eye. Students are using them in the practical lessons with high didactic success. Despite of six years of intensive use the quality of the material and differentiation of the anatomical structures is maximum. This fact let us give to undergraduate students and veterinary professionals a clear and accurate overview of the extension, limits and relationships of anatomical complex structures as the guttural pouchs, vascular supplies, pharynx, larynx, vestibulocochlear organ, eye, etc. These sections are also used to correlated sectional anatomy with modern diagnostic imaging techniques such as radiology, CT and MRI.

POLYMER PRESERVATION TECHNOLOGY: POLY-CUR. A NEXT GENERATION PROCESS FOR BIOLOGICAL SPECIMEN PRESERVATION

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Since its introduction in the late 1970's, "Plastination" has been the only process available to individuals interested in permanent biological specimen preservation. And over the intervening 25+ years, in the hands of trained preparators, it has proved to be a highly successful process. Recently, chemists at Dow Corning Corporation, in conjunction with C. Wayne Smith at Texas A & M University, have developed an alternate technology for permanent biological specimen preservation. This next generation process, which they call, "Polymer Preservation Technology", offers preparators several unique advantages:

Specimens can be impregnated at room temperature thus eliminating the need for a low temperature freezer. This saves cost and lab floor space. In addition, processing specimens at warmer temperatures makes them less rigid and increases their flexibility.

Several different polymer, crosslinker, catalyst combinations are available. The combination choosen provides the preparator with a more precise way to control the degree of specimen firmness and flexibility.

The polymers used in the process are all relatively thin. This increase the rate and effectiveness of their tissue penetration and significantly reduces forced impregnation time. The end result is better, faster specimen processing.

The use of less viscous polymers enhances the impregnation of skin, tunica albuginea, sclera, etc.. This makes syringe injection of polymer unnecessary.

Specimens are impregnated with a polymer and crosslinker mixture which does not thicken at room temperature. This significantly increases the shelf life of any mixed polymer. Also specimens can be left out to drain indefenitely; and all the recovered polymer can be reused.

Specimen curing in initiated immediately by wipping with a thin layer of catalyst. Therefore, the constant wiping and attention given to specimens during this process is markedly reduced.

Specimens prepared using this new technology will be on display.

SURGICAL EXPOSURE OF THE NERVES OF THE LIMBES IN DOG

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Twenty dogs were used in the present study to delineate the proper sites of exposure of the radial, median and ulnar nerves in the thoracic limb and tibial and fibular nerves in the pelvic limb.

The site, length, width and topographic relations of the subcutaneous parts of these nerves were perfectly described. The length and direction as well as the proper site of the incision were also determined. Blocking of the nerves at these sites was undertaken and the desensitized area for each was outlined. The specimens could be plastinated and preserved for teaching purposes.

PLASTINATION - UTILITY AND ADVANTAGES

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The plastination, relatively recent procedure for preparation and preservation of internal organs or even whole body slices, represents a certain benefit for the anatomical study. In Romania, as in the greater majority of the Eastern European countries, the main preservation and preparation procedures are based on toxic fumes (formaline), with a well known toxic action over the human body.

The plastination, relatively less known and extremely

rare applied in our country, offers some certain, major advantages: nontoxic conservation method with a perfect visualization of the anatomical elements and preservation of their normal aspect; perfectly clean, dry and odorless, with an easy handling and without risk of damage of the anatomical samples. According to us, the major advantage is represented by the durability of the anatomical specimens, because, nowadays, the access to biological material (human bodies or organs) becomes more and more difficult.

Apparently a problem, is obvious that the cost is counterbalanced by the advantages.

ARTERIES AND VEINS OF THE HEART INJECTED WITH COLORED EPOXY RESIN (BIODUR E20)

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The diseases of the heart especially the myocardial infarct and the disorders of the vessel supply of the heart are one of the most expanded diseases in the world. Detailed knowledge of the vessel supply of the myocardium and it's disorders may lead to development of diagnostic and therapeutic procedures that will allow reduction of the mortality rate of such diseases. Modern plastination methods will contribute to understanding the origin and course of this category of diseases. Epoxy resin E 20 (Biodur, Germany) has been used for the injection of dye into arterial and venous vessel network of the heart. A twenty percent formalin solution was used for the primary fixation of the material. The coronary arteries were injected by the use of a blunt cannula. The heart veins were injected with blue dye through the coronary sinus via the vena cava. The mixture of blue Biodur E 20 (in 100 parts) with the hardener Biodur E 2 (in 45 parts) was used for one injection. A total of 85 ml was used for the artery injection. A five percent formalin solution used for fixation of the heart after the colouring of the vessels was applied at a temperature of 5°C. The demonstration of the arterial and venous network of the heart by using the above-mentioned method enables medical students to obtain detailed knowledge of the vessel perfusion supply of the heart. Contingent disorders and anomalies in the vessel network of the myocardium are demonstrated and thus anatomy is linked with other clinical subjects in the medical curriculum.

EARLY EMBRYONIC INVOLUTION OF THE CAMEL GALL BLADDER

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Camel foetuses at CVR length of 24, 25, 47, 53, 90, 131, 163 and 168 mm were collected from Cairo slaughter house, these ages represent the early stages of prenatal development. The primordia of gall bladder and cystic duct were detected at 24 mm CVR length as a pear-shaped primordia which differentiated from the caudal part of hepatic premordia. At 47 mm CVR length, the hepatic duct system showed higher rate of growth and clear signs of canalization, in contrast to the gall bladder and cystic duct primordia remained solid. Also there was a mesenchymal condensation along the hepatic ducts which represent the future smooth muscle coat but no such mesenchymal condensation was obseved around the solid gall bladder premordia. In embryo of 35, 73 and 90 mm CVR length the situation described above became more prominent and the size of the gall bladder premordia remained constant or even reduced. In 131 and 168 mm camel foetuses, the gall bladder premordia was no longer visible. Foetuses could be plastinated and preserved for teaching purposes.

THE COMBINED TEACHING AND RESEARCH POTENTIAL FOR THE E12 SHEET PLASTINATION TECHNIQUE

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The E12 technique for transparent body slices was initially introduced to this Department for the teaching of cross-sectional anatomy to second and third year medical students, the ophthalmology primary course and second year dental students. The slices are also used for interpretation, by comparison, of images obtained by sophisticated techniques such as M.R.I, and C.T. scans. A portion of a cadaver, sectioned transversely from the sternum to the top of the head, was at first processed using the E12 drainage method. After the introduction of the technique the potential also became evident for these same specimens to be used in areas of research that were in progress in the Department at that time. Three academic staff members undertaking different areas of research, but within the same anatomical region, have utilised these first slices and two of these staff members have since had additional specimens processed specifically for their areas of research. One of these research projects is now completed and has been accepted for publication.

An acknowledged disadvantage of the traditional lateral approach to dissection of the temporomandibular joint (TMJ) is that detailed observations of the deeper medial part of the joint become impossible. In this study the joint was approached from its inferior aspect, which allowed viewing of its deeper structures from a new perspective. A striking feature observed was the existence of a horizontal band of tissue consisting of striated muscle bundles interspersed with fibrous tissue, in the posteromedial aspect of the mandibular

condyle. This has not been described before.

Demonstration of this structure by direct photography is difficult because of the depth of its position and its relationship to the surrounding bony structures. To overcome this problem, it was decided to show the structure in tissue sections of the joint. Joint specimens were sectioned in different planes and it was found that horizontal sections showed this structure best. Tissue sections processed by the E12 sheet plastination technique were superior to plain cryosections in demonstrating this structure. In resin sections the presence of this muscle band could be demonstrated very clearly, together with its relationships to the joint structures. The resin sections also closely matched magnetic resonance images (MRI) of the joint which were utilised to confirm the presence of the muscle band. In conclusion, the resin sections contributed greatly to the confirmation of the presence of this previously undescribed muscle band.

THE CONTRIBUTION OF PLASTINATION TECHNIQUES TO NEUROANATOMY TEACHING

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Over recent years this Department has experienced considerable problems in obtaining fresh brain material for teaching. As a result, considerable efforts have been made to utilize to it's fullest extent the small amount of material available. A great deal of work has been focussed on developing and extending techniques for the plastination of brains. The major types of specimens plastinated have included whole brains, half brains, horizontal, coronal and sagital slices, and prosections. In this manner it has proved possible to demonstrate a wide range of relevant features including the meninges, sulci and gyri, ventricular system, cranial nerves, major fibre systems, deep nuclei, the hippocampal formation, and internal capsule.

Conventional plastination techniques, such as the S10 procedure, make available well preserved dry, odourless, and nontoxic tissue for handling and study, and this is exemplary when external features are being studied. However, in order to highlight internal features (such as the distinction between white and grey matter), the P40 method, using the Biodur polymer P40, has proved invaluable. The P40 method was designed to supersede the P35 technique which has a longer production time and is more expensive. Both the P35 and **P40** procedures offer comparable results and have proved of It enormous value for the study of slices of varying thickness. Our department is only undertaking the P40 technique which has proved excellent for the demonstration of very fine anatomical detail, thereby making it an indespensable addition to the range of plastinated techniques currently available in neuroanatomy.

ANATOMICAL SECTIONS OF THE HEART REPRESENTING VARIOUS ECHOCARDIOGRAPHY CURVES (PARASTERNAL POSITION)

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A total number of 50 adult hearts was used in the present study. The hearts were fixed in 10% formalin. Embedding was done in gelatine. The hearts were sectioned in the presumed planes of the echocardiographic sections. The parasternal position is the most important transducer position because it allows visualization of the heart along all planes. There are four parasternal long axis views and six parasternal short axis views. For the purpose of identification and validation of these echocardiographic sections, anatomical sections were performed in the presumed planes of these echocardiographic sections and they were photographed with the same orientation as the ultrasound image.

However, comparing gelatine embedding with plastination we are in favour of the latter. Plastination needs no fluid fixative for preservation and so students can handle the specimens easily for demonstration and teaching. Furthermore, we faced difficulties in obtaining good sections through gelatine embedding but plastination can give good quality of sections.

PLASTINATION OF VASCULAR VARIATIONS: A CASE REPORT OF A SUBCLAVIAN-BICAROTID TRUNK AND A LEFT VERTEBRAL ARTERY ARISING DIRECTLY FROM THE AORTIC ARCH

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A very interesting vascular variation of the aortic arch was found on a 74 year-old man during the dissection course. The aortic arch gave rise to three branches: a subclavian-bicarotid trunk (from which arose both right and left common carotid arteries and the right subclavian artery), the left vertebral artery and finally the left subclavian artery (type F of Adachi, 1928). The specimen, including the aortic arch and the vertebral column, is currently kept in Kayserling's solution at room temperature before being further dissected for plastination (S10). The vertebral column was preserved so that the course of both vertebral arteries and especially through the foramina of the cervical transverse processes could be observed. This anomaly of the vertebral artery is supposed to be related to the persistance of the 4th or 5th intersegmental cervical artery (Bracard, 1983). The outstanding importance of all variations of the neck arteries for our students in chiropractic leads us to preserve this kind of vascular anomaly by the way of plastination.

PLASTINATION OF MUSCULAR VARIATIONS: A CASE REPORT OF STERNALIS MUSCLE

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An unilateral right sternalis muscle (type XI of Grisoli et al., 1951) was observed on a 45 year-old woman during the dissection course at our university. It was carefully dissected and the specimen, including the sternum, the first ribs with their cartilage, and part of pectoralis major was kept in Kayserling's solution at 4°C for 2 months. It was then dehydrated by freeze-substitution for 11 weeks, impregnated with S10 (6 weeks), and cured (fat-curing).

The sternalis muscle is an accessory muscle of the ventral surface of the thorax. It ascends usually from the lower costal cartilages and rectus sheath to blend with the sternocleidomastoid or attach to the upper sternum or costal cartilage. However, many variations have been described in the literature. Since its first report by Cabrol in 1604, a few hundred case reports of sternalis muscles have been published, but the embryological origin of this accessory muscle is still debated: extension of other muscles (rectus abdominis or its sheath, sternocleidomastoid, obliquus externus), equivalent to the pectoral cutaneous muscle of marsupial or to the anterior supracostal muscle, or part of pectoralis major. Though the sternalis muscle is not exceedingly rare, we decided to plastinate it, and to start a series of muscular anomalies for our museum of plastinated specimens. Every time we will find a sternalis muscle during the dissection course, it will be plastinated so that we could in the future compare these specimens, and try to understand the embryological development of this accessory muscle.

PLASTINATION TRAINING

At the last meeting of the Society, a point was brought in the new business under the name "PLASTINATION TRAINING". This resulted from a positive experience of sending a student from Trois-Rivieres to Graz for three months. We regularly receive requests from students how would be interested to learn more about plastination and participate to research on plastination, or to a research project where plastination is involved, in an overseas laboratory. We believe that some similar requests were also probably made in other laboratories.

After discussions, everybody aggreed that this kind of program would be good for the Society as it would contribute to give knowledge about the plastination technique to young students who would probably in the future participate to elaboration of new labs. It was suggested that a survey should be carried out on this subjects.

I would greatly appreciate your comments on the subject.

Did you have similar requests in the past?

Would you accept to receive in your lab a student for a period of 1 to 3 months?

Should these exchanges be undertaken on a one on one basis between the applicant and the plastination laboratory or should the Society be involved in this kind of program?

What should be the task of the Society in this kind of program?

Please send me your comments as soon as possible. The results of this survey will be published in the next issue of the Journal.

Thanks for your collaboration,

Gilles Grondin