OPTIMIZING OUR BRAINS

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In recent years, the use of plastinated brain material has become progressively more essential to our ability to teach neuroanatomy at our Medical School. For reasons relating to problems of gaining appropriate consent, we can no longer gain access to the large numbers of well-fixed brains necessary to teach neuroanatomy courses based on student dissection. We have thus progressively moved to a teaching system based on plastinated brain material, which can be used by multiple classes, year after year. Many of these preparations double as valuable museum specimens when they are not required in classes. The major types of specimens we have prepared are:

1. Plastinated whole brains- for demonstrations of surface features of the brain, including the meninges, features of the brain stem including the cranial nerves, and major sulci and

2. Sets of plastinated horizontal and coronal slices for demonstration of internal features, such as ventricular system, major fibre systems, and deep nuclei.

3. Plastinated prosections, for three-dimensional demon stration of deep brain structures such as the hippocampal formation and internal capsule.

This material is used to teach neuroanatomy to a wide range of classes, including medical, dental, science, physiotherapy, physical education, pharmacy and medical laboratory science students, a total of about 1000 students per year. The plastinated material has proven to be durable, can be easily accessed by students in the Anatomy museum out of laboratory hours, and has allowed us to use "real" brain material in our teaching, rather than converting to the use of models.

SCALING DOWN THE P-35 TECHNIQUE

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Polyester (P-35) plastination of brain slices results in specimens with excellent instructional potential. It is also valuable for certain kinds of research. If a person has extensive teaching and administrative duties, however, the conventional, high output, P-35 technique is far too time consuming. I have been using an attenuated (scaled-down) P-35 technique that maybe of interest to others who have extensive responsibilities but would still like to turn out useful specimens. In addition to requiring smaller increments of time, miniaturizing the P-35 technique offers an assortment of other advantages. For example:

1. It is far more conservative to resin
2. It is easier to maintain resin hygiene
3- It diminishes the release of styrene vapor.

The key to miniaturization is standardization of all aspects of the process. No more than 300 ml of resin is mixed at one time, permitting the production of one or two slices per day, at most. Small food storage vessels are used for mixing and processing and are cleaned immediately after use. Castings are prepared using smaller, standard-size glass plates which accommodate only one slice per chamber. Reusable gaskets for casting chambers are fabricated from heavy-gauge wire covered with plastic tubing. Degassing of castings is accomplished by returning them to the vacuum chamber. The finished specimen is trimmed to a standard size, labelled and stored in specially constructed standard carriers. Although not intended for maximum specimen output, this technique permits the busy teacher to plastinate and still attend to his or her other duties.

ANATOMICAL INVESTIGATION OF THE ARTERIES OF THE BRAIN IN ORDINARY GOATS WITH PLASTINATION TECHNIQUE

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ABSTRACT: To investigate the arterial vessels of brains, 22 goats were studied with the plastination technique (V. Hagens G, 1987, Nerantzis C, 1978, Guerra-Pereira, 1979). Injection solution, consisted of the following ingredients and proportions; polyester resin (DEVILUX, **CRYSTIC** 700), Catalyst, Accelerator and Solvent (styrene) are 100 ml, 5ml, 5ml and 50ml, respectively.

Goats were anesthetized by intraperitoneal injection of 0.5gr/kg chloralhydrate solution (in 10%). The left common carotid artery of each goat was ligated in the region of fourth cervical vertebra and cannule was inserted proximal to the ligation. After the bleeding stopped the injection solution was injected into the left common carotid artery in the same region following perfusion with saline in order to remove any remaining blood. Polyester casts of 12 goats were obtained in order to return the relationship between the injected vascular system and skeletal structures and to measure the internal diameters of the vessels. After hardening the polyester, in dilute hydrochloric acid, the cranium of specimen was skinned, later exposed and macerated in the water tank at 60° C for a period of 5-7 days.

The brain arteries of ten goats were investigated by the dissection.

The measurements of the external diameter of the casts of the arteries in the rostral epidural rete mirabile were made with compass (0.05 mm sensitive). The external diameter of the casts of the vessels was accepted as the inner diameter of the vessels and these were as 0.29 (0.18-0.56)mm. The rostral epidural rete mirabile was about 20-25 mm in length and 5-8 mm in height.

In formation of this rete mirabile, two branches of the maxillary artery, the caudal and rostral branches took a part. The blood supply of the brain was primarily from the internal carotid artery which arose from the rete mirabile but branches of the occipital and vertebral artery supply blood to the meninges and part brain without entering the rete mirabile. The internal ophthalmic artery arose from the rete mirabile. Between the caudal halves of the rete mirabile a minor anastomotic connection was seen but a similar connection was not found between the rostral halves.

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COMPARATIVE ANALYSIS OF SECTIONED WHOLE-ORGAN-PLASTINATED LARYNXS

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Thin slices of whole-organ-plastination allow a wide range of analysis. Due to the variability in thickness different post-plastination methods could be applied.

For this analysis 5 laryngoscopically unaltered subjects taken from the specimens of the institute of anatomy, were selected. CT and ultrasound-scans of the cervical region of each specimen was performed before removal of the larynx.

Each of the specimens was plastinated in whole. After fat removal and dehydration, the specimens were placed in the epoxy resin. Following evacuation and hardening of the specimens, 1,00mm parallel sections were separated by using a diamond-wire saw for precision slicing. The loss in material caused by slicing is as low as 0.30 mm per section.

The corresponding slices were compared in plastination, CT and Ultrasound.

It can be demonstrated, that the whole-organ-plastination and section of larynges improves the interpretation of the in-vivo diagnostics, CT, and Ultrasound images.

PLASTINATION OF SPECIMENS FOR RESEARCH AT FACULTIES OF MEDICINE OF FLORENCE AND PADUA

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Plastination techniques were used in our Institutes: A. To evaluate the preservation condition of some organs; B. To verify the constitution of the subperitoneal structure of the female pelvis.

A. It is generally reported that the S10 plastination technique allows the production of samples with the same volume, shape, color and structure of that of the normal organs.

In order to check the properties of the S10 technique, organs (Heart, spleen, liver, brain, cerebellum, and kidney) previously fixed in formalin for a long time were compared with autopic samples that had been immediately cold plastinated.

For the study, traditional radiological technique and computerized tomography was used.

Plastinated organs show better morphology as well as a better anatomical definition when compared to the formalin fixed ones.

B. Subperitoneal organs of the female pelvis were studied in four cases after removing the median viscera and their subperitoneal connective tissue, using the E12 technique.

The specimen was sectioned in 3-4 mm thick slices which were then fixed in cold acetone. Some of the slices were kept in acetone for several weeks at room temperature until lipid bodies disappeared.

Subsequently, the sections were plastinated and processed by standard procedures. The observation of the slices showed that the subperitoneal tissue surrounding the cervix formed fibrous-adipose expansions directed toward the urinary bladder and the rectum.

In the slices maintained in acetone at room temperature, these fibrous structures were thin and poor in adipose tissue.

These observations support the idea that fibrous structures are lacking in the subperitoneal tissue of the female pelvis.

HUMAN TISSUE ACQUISITION AND USE IN TEACHING AT THE UNIVERSITY OF AUCKLAND, SCHOOL OF MEDICINE:

The Increasing Value Of Plastination In The Development Of New Teaching Methods

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The development of an integrated anatomy/radiology teaching resource using embalmed cadavers and plastinated sections is discussed.

It is necessary to be able to study the human body in correlation with the rapid advances in radiographic imaging techniques especially in view of the different planes visualized by the use of computerized tomography (CT) scans and magnetic resonance imaging (MRI).

New teaching mediods are also being developed with emphasis on self-directed learning and clinical applications of anatomy.

To this end the Anatomy Department of die University of Auckland has developed a plastination program to prepare tissue slices in horizontal, sagittal and coronal planes, correlated with CT and MRI scans and accompanied by annotated explanatory notes.

In New Zealand, the acquisition, retention and disposal of all human material used in this project is governed by the stringent regulations of the Human Tissue Act.

THE USE, ABUSE, AND SURVIVAL OF PLASTINATED DISSECTIONS IN TEACHING HEAD AND NECK ANATOMY

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In our school, first year students do not dissect; instead they study models, museum specimens, and prosections. Formerly, with 75-80 students handling "wet" prosections each year, damage to specimens, storage, and chemical fumes were a constant problem. Therefore, in 1987, we began plastinating our teaching specimens by the S10 technique. As of April, 1994, 66 old and new sagittally sectioned head and neck preparations, dissected on both sides to maximize utilization, had been plastinated. After being placed in service for laboratory study these specimens are not pampered or protected in any special way, instead, they are subjected to all the typically careless manipulations of which first year students are capable. These preparations are also utilized by approximately 50 graduate and elective course students annually. Almost all specimens are studied during each of approximately 50 laboratory sessions per year, and at times, especially immediately prior to an examination, the handling becomes rather rough. Because of this, we now prohibit the use of probes, forceps, or any other solid objects with any plastinated specimen; broom straws and pipe cleaners serve very well as pointers. Between laboratory sessions, the plastinated specimens are stacked, one upon the other, in large, covered plastic boxes, but no other storage precautions are taken. In spite of all this constant abuse, the specimens have held up remarkably well. Some frequently occurring types of casualties are the following: muscles reflected to one attachment (e.g. the masseter) often become totally detached; smaller nerves and accompanying vessels that enter the bony foramina frequently have been broken (e.g. the major palatine and the posterior superior alveolar nerves). Although the chorda tympani nerve within the infratemporal fossa usually becomes separated from the lingual nerve, other small nerves, such as the mylohyoid nerve and the ansa cervicalis rarely have been damaged. Another type of dissection that invites abuse is one in which cervical visceral structures cannot be adequately anchored inferiorly. These preparations, as well as almost all of our posterior pharyngeal dissections, have suffered some damage primarily because students cannot resist pulling the carotid sheath structures aside to obtain a better view of the lateral pharyngeal region. On the other hand, many other structures, e.g. the glossopharyngeal nerve, the nerves and vessels of the tongue, larger vessels and nerves within the infratemporal fossa, and the structures in the sublingual region have usually escaped unscathed. Recently, we began tying strings to more deeply placed structures prior to plastination to assist students in locating them; this, plus protecting weak structures with small droplets of old S10 prior to curing, and using more delicate pointers have all helped to reduce damage. In conclusion, plastination of detailed dissections of the head and neck have been extraordinarily satisfactory in regard to prolonging specimen life, problem free storage, ease of structure repair, and the elimination of exposing students to hazardous chemicals.

Newly elected Society Vice-President making a strategic point

DEMONSTRATION OF VASCULAR ANATOMY IN PLASTINATION

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For some time a technical solution has been sought which could solve problems in (1) the understanding of complex vascular distribution to regions which are difficult to accurately reach through dissection; (2) the ability to visualize two dimensional radiographic images in the necessary three-dimensional manner. The specimens produced using these techniques are rendered translucent to transparent with vascular distribution patterns demonstrated with injected curable polymers. These subsequently epoxy-embedded specimens are useful in (1) study of normal regional vascular anatomy; (2) the training of students of radiology or radiological personnel in anatomical interpretation of radiographs including the study of neurovascularity for research in surgical anatomy; (3) Preoperative patient education; (4) the teaching of sectional anatomy for correlative interpretation of imaging such as CT and MRI.

PLASTINATION OF SPECIMENS FOR TEACHING AND RESEARCH IN FORENSIC PATHOLOGY

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In the field of forensic pathology, plastination represents a useful means of acquisition, preservation and demonstration of "evidence" for teaching purposes. The verification of this assumption results from a series of trials conducted by using whole organs and sections of viscera and brain plastinated with S10, E12, and P35 for examination by post-graduate students during a course in "Technique and diagnosis forensic autopsies" at the School of Legal Medicine at the University of Padua.

The brains, 5 cut according to Pitres and 5 to Flechsig methods, were plastinated with S10. Two millimeter thick sections were plastinated with P35. The students confronted the deep cerebral structures (basal ganglia, internal capsule and ventricular system) in two different planes. With the images of NMR they described the topography of the lesions.

Five hearts were plastinated in toto with S10 for the external examination. In five other cases, the atria were removed to allow for the study of the atrio-ventricular septum with the valvular ostia. In three cases, the anterior wall of the ventricles was removed to allow the ventricular side of the atrio-ventricular and semilunar valves to be studied.

Additional specimens plastinated: 1) Isolated aneurysm

bearing circle of Willis and after S10 plastination a diagram of the brain base was mounted for topographical evaluation;

2) Transverse sections of hearts plastinated with S10 and E12 were used to teach cardiac hypertrophy and dilation;

3) Sections of whole lungs plastinated with E12 were used for complete topographical evaluation of the extension and degree of pneumoconiosis;

4) in a case of a patient with traumatic rupture of the liver which had undergone surgery and survived two months, 2mm thick sections of the liver were plastinated both with the S10 and E12 techniques. The specimens show traumatic lesion, the surgical suture and a recent hematoma.

The unanimous favorable evaluation expressed by the post-graduate students confirms that plastination should be adopted as a permanent and widespread tool in teaching Forensic Pathology.

A REPORT OF PLASTINATION IN IRAN (THE ACTIVITIES IN THE PAST, THE PLAN FOR THE FUTURE)

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A report about the research in the field of plastination performed at Isfahan University of Medical Sciences, Iran. In 1990, after taking part in the International workshop of plastination held in Heidelberg, Germany, we began our research with the aim to start the method of tissue preserving by present auxiliaries in our country. Finally, in the summer of 1992 we produced the first plastinated specimens in Iran. These included 17 brain slices (both anatomical and pathological) in different planes. Later, we began other techniques of plastination (E12 and S10). During this research, we received the equipment needed for S10 technique, and our activities in this field continue.

THE PLASTINATION IN FORENSIC ANATOMY

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With the application of plastination to didactics and clinical medicine, we consider the use of plastination very important in Forensic Anatomy.

Because of the problems linked to formaldehyde fixed specimens, such as toxicity and suspected carcinogenicity, plastination has proven to be most valuable. Medical examiners often work with specimens in an advanced state of

decomposition which are hardly manageable from the aspect of odor and friability of tissues. As well tissue damage can be caused when samples are taken for subsequent report analysis or during removal in the case of exhumed material. Therefore, because of the cost and time involved in processing, one should limit the specimens to be plastinated, to "special" cases only.

Plastination allows the preservation of odorless, dry specimens which are easily manageable. If applied to organs injured by trauma (gun shots, knife punctures, etc.) plastination will preserve these specimens in their original shape and size. This proves to be most valuable for subsequent examination.

With the difficulties we have in our country using fresh, human parts for university medical teaching, we feel that plastination is a definite alternative. This technique will allow us to create an archives of plastinated forensic specimens which can be used for teaching.

THE USE OF SILICONE PLASTINATED SPECIMENS FOR LIGHT AND ELECTRON MICROSCOPY

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Plastination is a technique which permits the preservation of anatomical specimens in a physical state approaching that of the living condition. We have studied the possibility of using silicone plastinated fragments of the spleen and pancreas for optical and electron microscopy. We have found that, given an adequate fixation protocol, plastination can be used for both structural and ultrastructural studies. Initial difficulties in obtaining clean cuts were overcome by deplastination in sodium methoxide. Artifacts produced by the plastination/ deplastination procedure are almost eliminated by the use of a glutaraldehyde/formaldehyde fixation protocol. The (Biodur) silicone S10 polymer is transparent and stable to electron beams and plastinated tissues can be contrasted or colored in a similar way to tissues embedded in Epon 812. Thus plastinated tissues, as well as being very life-like, stable and easy to handle, can now be used as a source of material for electron and light-microscopic studies.

PLASTINATION OF FETUSES TO DEMONSTRATE VASCULARIZATION OF OSSIFIED BONE

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Demonstration of developing bone in fetuses using a process of clearing and staining with Alizarin stain is well known. However, the process is limited to small fetuses and specimens and must be stored in glycerin. Handling and investigation is thus limited.

We have developed a modified process based on clearing and staining of bone with opacification of the arterial tree, followed by plastination, that allows us to overcome the constraints above.

This process entails injection of a latex barium mass into the ascending aorta (allowing for roentgenographic examination) followed by tissue clearing in a KOH solution after removal of the skin and subcutaneous fat. Immersion in a solution of H_2O_2 of half of the fetus renders the muscles and soft tissue semi-opaque on that side. (This is not a necessary step but allows comparison of the left and right half of the foetus). The cleared fetus may be submerged in a solution containing Alizarin stain to demonstrate ossified bone.

Finally, the specimen is plastinated using the S10 procedure creating a dry specimen.

This process is a useful technique that allows handling and study of soft tissues, vascularization and ossification of fetuses older than 20 weeks. It is also possible to stain the cartilage simultaneously.

PLASTINATION OF BRAINS TO DEMONSTRATE NUCLEI AND FIBRE TRACTS

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Students of anatomy often express the difficulties they experience in understanding certain concepts in neuroanatomy. Brain sections are useful, but they do not demonstrate fibre tracts or nuclei in continuity.

In order to resolve these difficulties, we have devised a process that enables students to examine these structures in 3D.

Fresh brains are initially prepared by Klinger's method which enables dissections to be made that reveal the various fibre tracts and nuclei quite distinctly.

This process renders the brain more porous for the process of plastination than other standardized preservation techniques appear to do.

Following dissection the specimen is plastinated by the S10 technique. There is some shrinkage but this does not detract from educational value.

APPLICATION OF PLASTINATION IN EDUCATION AT PHILADELPHIA COLLEGE OF OSTEOPATHIC MEDICINE

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Philadelphia College of Osteopathic Medicine has established a state-of-the-art gross anatomy teaching center

consisting of a plastination laboratory dedicated to the preparation of permanent, dry plastinated specimens, a display room for student oriented learning, the gross dissecting laboratory, and the Angus G. Cathie Museum, all housed in the Anatomy Department.

The focal point of the teaching center is the display room where plastinated specimens have been prosected to show topographical anatomical relationships. These are available for handling and study by students and practitioners alike. Topographical relationships are correlated with cadaver dissection and radiographs, (CT scans and MR images), posted in the gross lab as each region of the cadaver is dissected. The preparation of plastinated anatomical specimens will eliminate the need to replace wet prosected material on an annual basis. More faculty time, will be freed up, for small group teaching and cross-sectional anatomy, which is so important in the understanding of diagnostic CT scans and MR images. The teaching center is actively supported through college summer work study programs which allow students to work at the center to help prepare prosected specimens from embalmed human cadavers. As plastinated specimens become available, they are introduced into the display room as teaching aids and serve as substitutes for selected routine student dissections. Students are given free time to study these plastinated specimens under the supervision of assigned faculty. The incorporation of plastinated material into the anatomy curriculum has enhanced the performance of our students on practical examinations. Plastinated tissue sections are now being prepared for the teaching of cross-sectional anatomy. Funding for the teaching center was provided by a grant from the Smith Kline Beecham Foundation's Funds of Osteopathic Colleges in the United States.

"USING PLASTINATED SPECIMENS TO TEACH THE BODY LAYERING CONCEPT CORRELATED WITH ULTRASOUND SCANS"

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The human body and its organs are formed by several tissue layers. Tissue layers consist of an aggregate of cells with similar structure and function as well as intercellular substance. These tissue layers of body regions are in some cases wide sheets and in many cases small sheets to wrap layer by layer of each organ.

For convenience, tissue layers are classified based upon location into four classes. The first class of the body tissue layers is termed somatic which means the multilayers found on each body layer from skin to cavity. In a region where a cavity is absent, the somatic tissue layers include the whole region from peripheral to deep. Limb regions are good examples of the later. The second class, extravisceral layers, indicates the sequence of viscera (internal organs) found within each region. The third class is intravisceral luminar organs and includes organs with a lumen such as digestive organs. The wall of each digestive luminal organ is wrapped into four major layers of tissue. The fourth class of tissue involves organs without a prominent lumen and is known as intravisceral nonluminal organs, such as the adrenal glands.

Each computer imaging modality, especially ultrasonography (1,2) is highly focused on the various tissue layers of the body and its organs. This presentation is restricted to an intravisceeral luminal class of organs and an intravisceral nonluminar class of organs seen in sectioned plastinated human specimens. A comparison of these types of sections and corresponding sonograms is the major approach of this study.

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FUNCTIONAL ANATOMY OF THE KNEE JOINT IN DEEP FLEXION: AN INVESTIGATION USING MAGNETIC RESONANCE IMAGERY (MRI) AND SHEET PLASTINATION

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The purpose of this study was to examine the relationships between ligaments, menisci and articular geometry of the human knee joint in deep flexion (>120 degrees). A fresh cadaver knee was placed in deep flexion (>150 degrees) prior to removal. This specimen obtained extended from mid-femur to mid-tibia and was fixed in 10% formalin for 4-6 weeks. Following fixation the specimen was stabilized in a gelatin mold and oriented using internal and external reference markers. MRI was performed on the construct. The specimen was sliced, in the sagittal plane, at 5mm intervals, to obtain sections representative of the images. The sections were plastinated using the E12 method of sheet plastination.

Analysis of the relative positions of the soft tissues and articular surfaces revealed: (1) The posterior cruciate ligament (PCL) was partially wrapped around the intercondylar notch of the femur; (2) The medial condyle contacts the tibia in the central third of the tibial plateau; (3) The lateral condyle of the femur contacts the tibia at the posterior rim of the tibial plateau and the posterior portion of the lateral meniscus is displaced posteriorly off the articular surfaces; and (4) The patello-femoral joint is congruent at the facets of the patella and the internal borders of the femoral condyles.

This study of deep knee flexion is significant with respect to the daily activities in Japanese and Muslim cultures as well as sporting activities such as curling and back-catching. The overall importance of the observations are best realized when compared to current orthopaedic total knee replacements (TKR) which typically receive a maximum flexion of 120 degrees.

AN ECONOMICAL APPROACH TO SHEET PLASTINATION

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In the past, most plastinators have not been interested in setting up a facility for sheet plastination because of the initial costs involved. Unless there is a great demand for sectional anatomy specimens, it is not economically feasible to buy the equipment for the process. Therefore it is important to develop methods to reduce the costs of this technique. Described here are several ideas and practical solutions to help the plastinator achieve this goal.

Newly Designated Distinguished Member Dr. Gunther and Bride Dr. Andrea boogie down.

USE OF PLASTINATED SPECIMENS IN A MEDICAL SCHOOL WITH A FULLY INTEGRATED CURRICULUM

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The Science University of Malaysia is the youngest of three medical schools in Malaysia, and the only one practicing the fully integrated system. Students are exposed to many disciplines at the same time. The Anatomy Department gives input to courses for students in Medicine (Yr. 1-3), Medical Technology (Yr 1), Diploma in Postgraduate Nursing, and Master's Program in Surgery and Medicine. Students do not do cadaver dissections, but are exposed to four types of learning materials. These are prosected wet specimens, plastinated specimens, pots, and models. In order to assist the department and plan the availability of teaching material, a survey was conducted among medical students in various years. They were asked to rate each type of material in terms of handleability, realism, informativeness, suitability for examination, and condition of the specimens. The results showed that students generally preferred plastinated specimens. However, with respect to being most informative and most realistic, wet specimens scored the highest. In conclusion, plastinated specimens have a definite use and preference in teaching anatomy where detailed knowledge is not essential, but prosected wet specimens still have their place in our medical school.

PLASTINATION MODEL OF STOMACH FOR GASTRO-DUODENAL ENDOSCOPY TRAINING

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AIM

Our aim was to develop a model of the stomach for trainee endoscopists in surgery and gastroenterology.

METHOD

An en-bloc specimen of a fresh esophagus-stomach-duodenum was removed at autopsy from a healthy adult male. The specimen was washed with water, cleaned and then fixed in Kaiserling's solution overnight. The next day the esophagus was cannulated and, from a height of 300mm, Kaiserling's solution was run in to the specimen while it was completely immersed in the same solution. It was similarly dehydrated, by running acetone through it while immersed in 2.5-3L of acetone. Dehydration was completed in 18-24 hours.

Next the specimen was wiped dry, placed in a dessicator and immersed in S10 solution in a deep freeze, under negative pressure. When bubbling stopped, the specimen was removed, wiped dry and cured with S6 in a chamber. Vaporized S6 was also introduced into the stomach using a vacuum flask. After 24 hours, the specimen was distended by low positive pressure which helped to maintain its form. At this stage a hollow specimen of the upper GI-Tract could be viewed through an endoscope. The distended hollow specimen was placed on a flat surface (300 x 400 sq mm perspex) and stabilized by using an adhesive. Electrodes were attached at strategic points within the mucosal lumen and were connected to a system of bulbs and batteries. These electrodes were connected to the positive pole A battery. The negative pole consisted of a probe

which on contact with the positive electrode completed the circuit to illuminate the bulb. Each bulb had a specific point on the mucosal surface of the specimen. When these lit the exact location of the probe (endoscope) was determinable.

CONCLUSION

Provided that the metal tip of an endoscope closes the electric circuit, and the esophagus and the pylorus are wide enough, this model can be used for trainee endoscopists who need to learn to spatially orientate the endoscope. This may be useful prior to an apprenticeship in surgery. The disadvantages include the static form and non-pliability of the specimen.

PLASTINATION IN CHIROPRACTICAL TEACHING: CRITICAL ANALYSIS AND PLACE OF PLASTINATED SPECIMEN IN ANATOMICAL PEDAGOGICS

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The recent creation of the first French-speaking doctorate in chiropractical science opens up new prospects for the development of plastination in anatomical teaching. Thus, the establishment of the sole Quebecer plastination laboratory in the University of Trois-Rivieres represents an unexplored field in the potential of plastination. The aim of this study is to analyze the reactions of 45 students (28 females, 17 males) to this new technique through their responses to a multiple choice question paper.

1. 87% of students believe that plastinated specimens are not able to replace the dissection, but 98% of them answer that such specimens are helpful during dissections.

2. 100% of the students regard the lectures as the cornerstone of anatomical pedagogics, the other approaches are in decreasing order: demonstration on cadavers, demonstration on plastinated specimens, dissection, audio visual aids, and finally, personal study.

3. The most interesting plastination technique is the S10 one for 51% of the students (respectively 31% and 18% for E12 and P35 techniques).

4. For the three plastination techniques that have been analyzed, the most prominent advantage and disadvantage are respectively:

A) S10: dry specimens (advantage), lack of flexibility (disadvantage).

B) El2: respect of topographical relationship (advantage), the vessels are not injected with colored polymer (disadvantage).

C) P35: contrast between grey and white matters (advantage), no transparence and vessels not injected with colored polymer (disadvantages).

This analysis reinforces the importance of plastination in anatomical teaching, opens up new prospects for its development, and encourages us to take some preferences in the production of plastinated specimens intended for anatomical teaching in chiropractical science.

THE CONDENSATION OF MOISTURE IN A ATMOSPHERIC AIR SUPPLY: A METHOD TO OBTAIN DRY AIR FOR PLASTINATION.

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INTRODUCTION

In 1979, Dr. Gunther von Hagens introduced plastination process, a means by which all fluid in biological material is replaced with resins of silicones (S10).

Forced impregnation with S10 occurs when the intermediate substance, namely acetone, is extracted under controlled vacuum. To control vacuum, dry air should be fed into the vacuum chamber, as moist air condensates in cold (-25 degrees C) S10.

AIM

The aim of this exercise was to find an inexpensive, yet effective process to obtain a constant supply of dry air.

METHOD

Atmospheric air flows through a column, filled with silica gel, before being bled into the S10 plastination vacuum chamber. The cylinder is 35mm in diameter x 500mm in height. After two hours, it is noticeable that the silica gel turns pink as a result of the introduction of damp air, and is completely saturated with moisture after 48 hours. Ice crystals then form in the inlet to the metal vacuum chamber, indicating that the silica gel is no longer effective. In order to abbreviate this problem and due to the fact that moisture in atmospheric air, when fed into a cold metal container, will always condense on the insides of such a metal container was coupled to the column containing slightly damp silica gel. The metal container in this case was an old gas cylinder with a 25mm silicone pipe inlet and a 12mm copper outlet. The diameter of the cylinder being 230mm and the height 350mm. This container was placed next to the vacuum tank in the deep freeze.

RESULTS

When 15 lmm of air per minute was forced through this container it resulted in such dry air, that the silica gel in the

column turned bright blue. The air that had passed through the metal container was so dry that it now acted as a dehydrant. The inlet to the vacuum chamber remains free of ice due to the moisture free air. The column with silica gel can be removed, as it has been proven that the air now flowing through the metal container is dry.

CONCLUSION

This installation can function effectively without the silica gel and the cost and labor are concomitant. At an average humidity of 40%-50% and at a rate of 15 lmm air per minute and during experimental period of 14 days, it has been determined that condensation of 1 liter water can be prevented in S10 every 20 weeks.

PLASTINATION OF SPECIMENS FOR TEACHING AT FACULTIES OF MEDICINE OF FLORENCE AND PADUA

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Plastination techniques are used for preparation of organs and sections of the viscera for teaching purposes at the Schools of Medicine of the University of Florence and Padua.

In the Anatomical Institutes of the two faculties, a standard unit of plastination was used for S10 plastination of autopic organs at room temperature according to the suggestion by Von Hagens et al. Subsequently, a cold impregnation technique was used which allowed the production of samples which closely resembled in shape and color their normal counterparts as well as showing a significant reduction in the resin consumption.

E12 and P35 standard techniques were used for plastination of sections of viscera and brains. Lastly, a technique utilizing formalin-fixed organs was studied using material previously preserved in anatomical museums.

In our Institute, the students attending the course of human anatomy are presently allowed to make use of:

A) S10 plastinated organs such as: entire sectioned hearts, livers, (showing the hilus and the excretory apparatus), spleens, kidneys (sections of the renal sinus and the major and minor calyxs); sagittal and transverse sections of the cerebral hemispheres (basil nuclei, cerebellum) and uterus with ovaries.

B) P35 Plastinated Brain (frontal and horizontal sections showing subcortical structures as well as the cavities of the ventricles).

THE USE OF RESIN CASTS VERSUS LATEX IMPREGNATED PLASTINATED KIDNEYS AS A MODEL FOR MORPHOMETRIC ANALYSIS OF THE HUMAN RENAL VENOUS SYSTEM

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INTRODUCTION

There are various methods of vascular morphometric analysis.

AIM

The aim of this study was to determine the suitability of resin casts and latex impregnated plastinated kidneys as models for renal venous morphometric analysis.

MATERIALS AND METHODS

One hundred and fifty three morphologically normal en-bloc renal specimens (131 males, 22 females) were randomly harvested from post-mortem examinations.

From the samples, 53 pairs were injected with different colored latex to exhibit the venous (blue), arterial (red), and pelvic-calyceal (yellow) systems and subsequently plastinated using the S10 technique with S6 cure, a modification of the technique described by Von Hagens (1980). The remaining 100 pairs were injected with similarly colored polyester cystic resin and casts were prepared according to the method described by Tompsett (1970).

RESULTS

The modified plastination technique displayed variable shrinkage patterns (up to 15%). Shrinkage was not observed with resin cast preparation.

DISCUSSION

Various modalities may be employed for vascular morphometric analysis. Embalmed cadaveric material demonstrates varying shrinkage patterns detrimental to this process. Advanced radiological imaging modalities (angiography, CT, MRI, ect...) are probably the most accurate in assessing these measurements. However, anterio-posterior projections are only a limited factor. Latex impregnation and plastination is a major advance, but the technique employed requires refinement to overcome the shrinkage factor. The employment of resin casts for renal venous morphometric analysis, while not claiming greater accuracy, is no less accurate than previous studies (Anson et al 1948, Gillot 1978).

CONCLUSION

The technique of resin cast preparation for renal venous morphometric analysis was found to be more suitable than latex impregnated plastinated renal specimens.

THE USE OF RESIN CASTS AND LATEX IMPREGNATED PLASTINATED KIDNEYS AS MODELS TO CLASSIFY PATTERNS OF RENAL VENOUS DRAINAGE

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INTRODUCTION

Variations in the patterns of drainage of the renal veins are well described (Smithuis 1956, Merklin and Mitchell 1958, Skyes 1963, Gillot 1978).

AIM

This study aimed to formulate a practical classification of the patterns of drainage of the renal veins using renal casts and latex impregnated plastinated kidneys.

MATERIALS AND METHODS

One hundred and fifty three en bloc renal specimens (131 males and 22 females) were randomly selected from post-mortem examinations. Cadavers displaying abdominal trauma, evidence of previous surgical exploration of the abdomen or abnormal intra-abdominal macroscopic pathology were excluded. From this sample 53 pairs were injected with different colored latex to exhibit the venous (blue), arterial (red), and pelvi-calyceal (yellow) systems and subsequently plastinated using a modification of the technique described by Von Hagens (1980). The remaining 100 pairs were injected with similarly colored polyester cystic resin and casts were prepared according to the method described by Tompsett (1970).

RESULTS **AND DISCUSSION**

Three major classification types were identified using the drainage pattern of the primary renal vein tributaries and the main renal vein as a basis on both the left and right sides.

A) Type IA consisted of two primary tributaries only eg. upper and lower, occurred in 38.6% while Type IB had in addition to the primary tributaries described in Type IA, a posterior primary tributary and occurred in 25.2%.

B) Type IIA displayed more than two primary tributaries eg. upper, middle, and lower, occurred in 11.8% while type IIB had in addition to the primary tributaries described in Type IIA, a posterior primary tributary and occurred in 10.1 %.

C) Type III consisted of any of the combinations in Types I and II and an additional renal vein occurred in 14.4%.

Resin casts and latex impregnated plastinated kidneys were both found to be suitable to demonstrate the variations in patterns of drainage of the renal veins. A classification system that is practical and has surgical and uro-radiological significance is proposed based on these models.

WHOLE-ORGAN-PLASTINATION APPLICATIONS IN LARYNGOLOGY

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Series of total organ sections have proven to be useful in the evaluation of the growth behavior of malignant tumors in the head and neck as well as the larynx. Histological techniques, (i.e. embedding in celloidin or paraffin), are difficult to produce and require extensive amounts of time. The goal of this study was to present the possible applications of plastination in the field of laryngology.

The human larynx specimens plastinated in this examination included 25 anatomically unaltered specimens and 25 which were pathologically altered. Each of the specimens was plastinated as a whole. After fat removal and dehydration, the specimens were placed in the epoxy resin. Following evacuation and hardening of the specimens, 1.00 mm parallel sections were separated by way of a diamond-wire saw for precision slicing. The loss in material caused by slicing is as low as 0.30mm per section. In the same manner, sections with thickness ranging down to 40um were produced. In conclusion, these sections were stained (Goldner, HE, and Toluidin Blue).

The entire procedure yielding complete plastinated specimens required no more than 3 weeks. The degree of shrinkage associated with this method is limited to less than 10% of the unfixed organ size. After staining, the increase of contrast between the various tissue types in the specimens enabled an exact differentiation between tumor and laryngeal tissue. The borders of the tumor's invasion were much easier demonstrable in this condition.

The plastinated specimens are ideal for instructional and research purposes. Pathological situations can be analyzed and evaluated in both their macroscopic and histological aspects.

USE OF PLASTINATED BRAIN SECTIONS FOR MEDICAL EDUCATION

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Teaching and learning of neuroanatomy is usually difficult because of the complex internal and external structure of the human brain. The use of plastinated brain specimens may be helpful since it enables medical students to understand the three dimensional structure of the organ. Therefore, we established several plastinated series of brain sections. Details of the procedure were shown in a poster. Briefly fixed brains were cut in slices (Approx. 5mm) in frontal, horizontal or sagittal planes, dehydrated and infiltrated with P35. Each slice was photographed and the important structures labelled on

the pictures. The sections were then installed in frames so that the complete brain could be reconstructed and each slide could be examined separately. In parallel, the photographs were composed as an atlas. Both atlas and framed brain sections were attached to a table offering free access for medical students.

World travelors await reception at Graz City Hall

SHEET PLASTINATION: IMPROVED VISUALIZATION OF BLOOD VESSELS AND NERVES

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The present sheet plastination procedure can be supplemented by vascular injection of fresh specimens. Veins can be shown best, when the cadaver is fresh enough to permit a retrograde filling with its own blood. For an arterial injection (prior to freezing and sawing), a warm solution of 10% gelatin, stained with red pigment dye, and containing barium sulfate (120 g per 100 ml gelatin solution) offers various advantages. This solution does not enter the capillary bed. It can be consolidated right after the injection (using cold water), the barium-added reduces the shrinkage during dehydration, and its radiopacity allows x-ray studies of the specimens.

The results of impregnation of staining attempts for nerves were discouraging. However, nerves can be demonstrated to a better extent in the cured sheets by simple lighting tricks: direct light from above, with the specimens on a dark surface, allows for an improvised visualization and photographic documentation of all myelinated nerve fibers.

IMAGE DATABASE OF PLASTINATION MATERIALS

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We have prepared about 100 plastinated samples from fixed human and animal specimens for research and education in anatomy. To catalog the materials, an image database of the plastination specimens was constructed on a personal computer, using a Macintosh Ilei (Apple Co.), with filemaker (Claris) we were able to input and keep text index on specimens, consisting of index number, source, methods, fixation, slide number, prosector, specimen name, sex, age, and comments. Images were taken as 35mm color slides and digitized with a slide scanner (NICON) or captured directly by digital still camera (Fuji Film) into a Macintosh HyperCard.

SELECTING AND MODIFYING A BAND SAW FOR USE IN SHEET PLASTINATION

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A modified meat cutting bandsaw is needed to produce plastinated thin cross sections of the whole body as well as sections for incorporation in computer animated teaching programs. This paper will discuss the specifications and modifications of bandsaws for optimum cleanliness and precision of the slices. The size of the saw to be used depends on the largest specimen to be sectioned. Blade speed and blade design influence the appearance of the cross sections. The design of the saw table and the fence determines the accuracy of the thickness of the saw product. Several design combinations will be compared, and a price range for models and modifications will be given.

PLANNED BUILDING ALTERATIONS TO COMPLY WITH FIRE CODES AT IOWA STATE UNIVERSITY

Wolfgang Weber Iowa State
University, Ames, Iowa

Freeze substitution and degreasing for plastination and degreasing of skeletons for teaching anatomy require significant amounts of acetone that exceed the limit for class I flammable liquids (10 gal/100 ft of laboratory space). At Iowa State University funding of $ 120,000 has been approved to convert a laboratory to a state flammable liquid handling facility. This paper will discuss the safety features to be provided: A). Explosion proof electrical installations B). Ventilation to maintain low air/fuel mixture C). Back up power D). Two hour fire separation walls and 1.5 hour fire door E). Sprinkler system F). Spill containment tank or basin G). Blow out panel.

ACETONE GAS DETECTOR FOR PLASTINATION

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Vacuum forced impregnation is the central most important step in plastination. Usually, the specimen soaked with acetone is placed in the polymer solution. Due to the difference of the vapor pressures, acetone in its gaseous state is continually extracted (boiled) out of the specimen, and is sucked up through the surrounding polymer mixture. At the same time, the polymer is drawn into the tissue and completely replaces acetone. During the vacuum forced impregnation, one normally has to check the gas bubble formation of acetone in the impregnation container. The gas bubble formation of acetone is a useful indicator of the speed of impregnation. In the last days of impregnation, when the pressure is at a 5mm/ Hg or lower, acetone gas bubbles cease to rise to the polymer surface or rise only very slowly and sparsely, bursting with splash at the polymer surface.

Recently in our plastination laboratory, we designed an acetone gas detector which connects the impregnation container with the vacuum pump. This acetone gas detector readily shows the presence of the strong or weak acetone vapors. In other words we use the acetone gas detector instead of observing the gas bubble formation of acetone to determine the progress of impregnation. During the last days of impregnation, use of the acetone gas detector is very useful and convenient to ascertain whether the forced impregnation is completed.

Editors Note

Now accepting fully completed articles from previously submitted abstracts.

Thank you.