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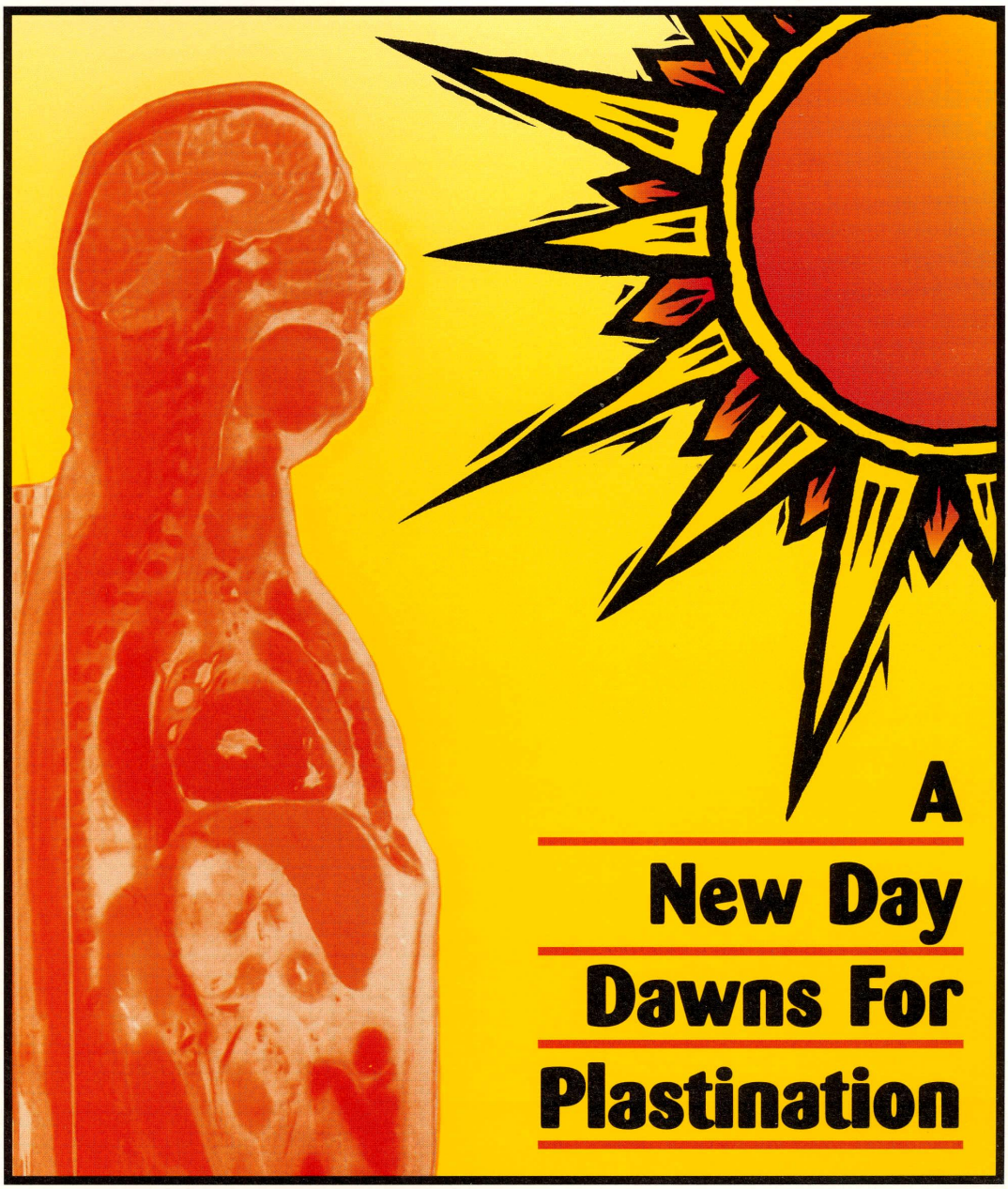
for PLASTINATION



A New Day Dawns For Plastination

JOURNAL of the

INTERNATIONAL SOCIETY FOR PLASTINATION

Official Publication of the International Society for Plastination

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Editor's Message

What an exhilarating feeling to be part of the official organization of and to be elected as editor for the "International Society of Plastination."

I would like to thank all who participated at Graz, especially Dr. Weiglein and his super staff, the speakers, poster presenters, and all in attendance. Wow! It was nicer than I had anticipated.

We must now begin to address the many problems any new organization faces. I challenge each plastinator to contribute one article yearly to our journal and help us advance our organizational goals. As we learn - we grow. We have elected extremely capable leadership and with the foundations previously laid by our distinguished plastination members we will succeed as a viable organization.

Thank you again for the confidence you have placed in the editorship of your journal and we pledge to do the best job possible.

Sincerely,

Dale Ulmer, P.A.

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President's Message

Dear plastination colleagues:

Wow! what A **FANTASTIC** job Dr. Weiglein and his staff did to organize such a "superb conference"! Everything was perfect. Andreas, I want to publicly thank you and all of your staff who made the 7th International Conference on Plastination the best plastination event yet. Your wife, Marion, deserves a Great BIG Thank You for the **TREMENDOUS** spouse program. The social events were marvelous as well as lively. If you were unable to attend, you missed a highly organized and very informational meeting. The scientific papers were excellent and covered many topics. Each conference that I have attended has been great. One wonders how each subsequent conference can be significantly better.

The 4th biennial meeting of the International Society for Plastination was historic. We are now an official body. Bylaws and constitution for the ISP were written and adopted. A slate of officers for the ISP were proposed and elected. I want to thank you for the vote of confidence in electing me as the first president of the society. This new job is a tremendous challenge and I pledge to do my best. We welcome any suggestions. We are in the process of appointing committees to work on several projects. Items of pressing importance are: Finance - both dues and corporate sponsorship, Communication - the journal, Internet, and advancing plastination, and Reaching and including new people. The new Internet computer communication system set up by Ron Wade will help facilitate communication **(LISTSERV@UMAB.UMD.EDU).**

I want to invite you to mark your calendars now and attend an interim scientific meeting on plastination, July 12 - 15, 1995. It will be hosted by two sister institutions The Ohio State University, Columbus, Ohio and Ohio University, Athens, Ohio. It promises to be a great interim gathering. Presentations will be by poster and platform as well as a hands on workshop. Also, mark your calenders and start planning for the 1996 Brisbane meeting.

Finally, I want to thank Dr. Harmon Bickley for bringing the plastination technology to the USA. He was instrumental in starting the International Society for Plastination. Harmon served as the director of ISP from its inception and as the first editor of our journal. Thanks!

Please inform me or any of the executive committee if you have any special needs, problems, or desires. We want the organization to serve you and your needs. I am looking forward to seeing many of you in Ohio, USA, in July, 1995, and in Brisbane, AUSTRALIA, in 1996.

R. W. Henry, D.V.M., Ph.D.
President of ISP

THE 7TH INTERNATIONAL CONFERENCE ON PLASTINATION
Graz, July 24-29, 1994

The 7th International Conference on Plastination in Graz was a success. 150 plastinators from 30 countries attended, 43 papers were presented from the platform and 19 posters were demonstrated. The abstracts were published as a newsletter of the International Society for Plastination (ISP) by Dale Ulmer. Two days of basic lectures covered principles, news and developments in the standard silicone as well as in the sheet plastination techniques. As the 1st International Conference on Plastination took place in 1982, we needed to learn about the history of plastination. Besides the history of the society and of it's journal, we got to hear about the development of plastination, which meanwhile has become so well known that it can be found in the encyclopedia. Gunther von Hagens gave an overview glimpse of the days when the plastination technique was born. For any one interested in plastination, Ron Wade presented a very helpful and inexpensive tool by which plastinators all over the World may communicate within seconds. This was the birth of the Internet mail system for the International Society for Plastination. It was set up at the University of Maryland at Baltimore.
(**LISTSERV@UMAB.UMD.EDU**).

Wednesday was free of lectures and reserved for tours through the old town of Graz in the morning and through the Institutes of Anatomy, Histology and Pathology in the afternoon. The last two days of the week were used to show and discuss the applications of Plastination in teaching and research. My very special wish to show the value of plastination for research was fulfilled by presentations covering problems in anatomy, histology, embryology, pathology, forensic medicine, orthopedics, otolaryngology, neurology, urology, radiology, and (endoscopic) surgery as well as in veterinary medicine.

The 4th Biennial Meeting of the ISP on Thursday afternoon was of historical importance for our Society. The bylaws and the constitution of the ISP, correlated by Blake Gubbins were adopted. A slate of officers for the ISP were proposed and elected: President - Robert W. Henry; Vice President - Karine Oostrom; Secretary - Andreas Weiglein; Treasurer - Ronald Wade; Editor - Dale Ulmer; Assistant Editor - Wayne Lyons. Both the inventor of plastination, Dr. Gunther v. Hagens, and founder and executive director of ISP for 12 years, Dr. Harmon Bickley, were elected "distinguished members" of the ISP. Finally, Brisbane, Australia, received the honor of hosting the 8th International conference on Plastination in 1996. Good luck to Robbie Boyes!

There were many outstanding social events such as the reception in the city hall by the Mayor of Graz, the reception in the castle by the Governor of Styria, and a sight seeing tour through the old town of Graz. However, the social highlight of the conference, which was enjoyed past midnight, was the "Styrian evening" in the surroundings of the beautiful "Landhaus" -the headquarters of the Styrian government.

The excellent facilities at the Institute of Anatomy in Graz, the friendly and competent team of this institute, including the head of the department, Prof. Anderhuber, who was with us most of the time, made this conference a real success. The hospitality of Graz and six hot and sunny days added to the delight of this memorable week. This was confirmed by many letters, of which I wish to cite two sentences which are representative of all the letters:

"The Institute of anatomy in Graz is a model academic institution which serves as the standard for other institutions to follow." (Wayne Smith, Texas).

"The final night of stories, laughter and farewells was quite emotional and with all truthfulness it was rather difficult to leave Graz the next morning. Many firm friendships have developed as a result of the congress" (Peter Cook, New Zealand).

Looking forward to meeting you all in Brisbane, Australia, 1996.

Andreas H. Weiglein, M.D.
ISA Secretary

BYLAWS AND CONSTITUTION
of the
INTERNATIONAL SOCIETY FOR PLASTINATION

Article I. NAME

The name of the organization shall be: International Society for Plastination, hereafter referred to as the Society.

Article II. NATURE

The Society is a multidisciplinary organization, including persons within all fields of Science interested in the technique of Plastination. Plastination refers to the use of polymers to infiltrate and preserve any material for teaching, research or diagnostic purposes.

Article III. PURPOSE

The purpose of the Society, as contained in the Letters Patent shall be:

a) to provide for and maintain an International Association for individuals and Institutions who perform plastination techniques, or are interested in plastination preservation methods;

b) to serve as a forum for the exchange of information about plastination;

c) to define plastination as a speciality area of professional activity, to encourage other institutions to adopt plastination preservation methods, and to invite individuals to learn and practice plastination as a career in the sciences;

d) to publish the Journal of the International Society for Plastination on a regular basis;

e) to hold regular meetings, workshops and conferences to promote and teach the techniques of plastination;

f) to maintain a record of member institutions and individuals performing plastination, their particular speciality, and others interested in plastination.

No part of any earnings of the Society shall inure to the benefit of, or be distributable to its members, officers or other private persons, except that the Society shall be authorized and empowered to pay reasonable compensation for services rendered and to make payments and distributions in furtherance of the purposes set out above.

Article IV. MEMBERSHIP

Section 1. Classes of members.

The Society shall consist of four classes of membership: Regular members, Associate members, Distinguished members and Emeritus members. Unless otherwise stated, membership is by way of application to the Membership Committee.

Section 2. Regular members.

Any individual interested in plastination is eligible to apply for Regular membership. Regular Members shall be eligible to vote at General Meetings, hold any office in the Society and receive its publications.

Section 3. Associate Members.

Government departments, University departments, Libraries, Private Institutions and others shall be eligible to join as associate members. Associate members shall receive the publications of the Society, may appoint a delegate to attend General meetings and vote at General Meetings. Delegates may not hold office in the Society.

Section 4. Distinguished Members.

At the Biennial General Meeting members may elect to the position of Distinguished Member, any Regular Member who, in the opinion of those present has made outstanding contributions to the field of Plastination. This is usually, but not exclusively, related to the organization of major Conferences, or other similar contributions. Such designation is purely honorary, and shall have no financial or other benefits.

Section 5. Emeritus Members.

A Regular Member may become an Emeritus Member upon retirement and by submitting written notification to the Vice-president. Emeritus Members shall have all the rights of Regular Members.

Section 6. Dues.

The executive, at the Biennial General Meeting, and with the majority vote of those present, shall set the annual dues according to the needs of the Society. Membership shall be for the calendar year, and be payable in advance. New members who apply after September 30, in any given year shall have their dues applied to the next year. Emeritus Members shall not be billed for membership.

Section 7. Termination of Membership.

A member who has not paid dues by the first day of June shall be deemed to be no longer a member of the Society, and shall lose all rights thereof. Reinstatement of membership will include re-application to the Membership Committee, and, notwithstanding Section 6, payment of all back dues accrued, to a maximum of two years dues.

Section 8. Expulsions.

Membership of any member of the Society may be terminated for just cause by a two-thirds affirmative vote of the eligible voting members at the General Meeting.

Article V. MEETINGS

Section 1. Biennial Meetings.

The Society Membership shall regularly meet at the Biennial International Conference, or at such other time and place that the members shall resolve. A meeting of officers and a General Meeting shall be held to conduct the business of the Society.

Section 2. Other meetings.

Special meetings of the membership shall be called by the Executive on written requisition of members carrying not less than 20% of the voting rights.

Section 3. Conduct of Business.

Business of the Society shall be transacted at the Biennial General Meeting. Conduct of the meeting shall adhere to "Robert's Rules of Order" (revised) in all cases to which they are applicable, and in which they are not inconsistent with the bylaws or other rules adopted by the Society. Every resolution shall be determined by a majority of votes unless specifically provided by statute or these bylaws.

Section 4. Notice of meetings.

The President shall give written notice of Biennial General Meetings and Special Meetings of the membership as a whole by mailing to each member a notice stating the place, date and hour of the meeting and, in case of a Special Meeting, the purpose of which the meeting is being called, and give sufficient information to members about such purpose to allow them to form a reasoned judgement on any decision to be taken. Written notice of Special Meetings and Biennial General Meetings shall be given not less than sixty days before the date of the meeting.

Section 5. Quorum.

A quorum for transaction of business shall be not less than 20% of Regular Members in good standing, delegates for Associate Members in good standing, Distinguished Members in good standing, Emeritus members and assigned proxies attending the Business Meeting.

Section 6. Voting and Representation.

Each Regular Member, each delegate who is appointed by an Associate Member, each Distinguished Member and each Emeritus Member who is present, shall be entitled to one vote on each issue at any duly convened Business Meeting of the Society. Regular Members, delegates of Associate Members, Distinguished Members and Emeritus Members who cannot be present at a Business Meeting may designate another Member in good standing to vote on his/her behalf with an assigned proxy. Proxies are to be in writing and may be in the form as sent with every notice sent pursuant to Section 4 above.

Article VI. OFFICERS

Section 1. Executive Officers.

The Executive Officers of the Society shall be the President, the Vice-president, the Secretary, the Treasurer and the Editor of the Society's Journal. All officers shall be elected by the membership at the biennial general meeting in accordance with Article VII. The Journal Editor shall be elected for a four year term , to be in effect beginning 1996. Term of office for all other officers shall be for two years and all shall be eligible for re-election.

Section 2. President.

The President shall be the chief executive officer of the Society, shall preside at business meetings of the Society, shall be responsible for executing policies determined at the business meetings, shall act as spokesperson for the Society, be its legal representative and be an ex-officio member of all committees.

Section 3. Vice-president.

The Vice-president shall assist the President in the performance of his/her duties and assume these duties in his/her absence. The Vice-president shall also chair the Membership Committee.

Section 4. Secretary.

The Secretary shall be responsible for the minutes of all business meetings of the society and answer all general correspondence directed to the Society.

Section 5. Treasurer.

The Treasurer shall be responsible for all monies and valuable effects in the name and to the credit of the Society, and for full and accurate accounting of receipts and disbursements in books belonging to the Society. The Treasurer shall have signatory powers and shall disburse the funds of the Society as may be ordered by the Executive. The Treasurer shall provide a financial report on the status of the Society at the Biennial Business Meeting, or when requested by the Executive.

Section 6. Journal Editor.

The Editor of the Society's Journal shall be responsible for obtaining articles, selecting and editing copy, layout, printing and distribution of the Journal. He shall also Chair the Journal Committee. A further function shall be the publication of a newsletter, to be distributed quarterly if possible, or as warranted. Only current members shall receive these publications. Others may purchase the Journal or the Newsletter for such price as may be decided by the Editor. (Currently US$10.00 for the Journal).

Article VII. ELECTIONS

Section 1. Time and Place.

Election of all officers shall take place biennially at the General Business Meeting, and shall be the last order of business at this meeting.

Section 2. Nominations.

In January, prior to this meeting, the Nominations Committee shall mail out to each member, a call for nominations. Each member may nominate one person for each Executive Office, and shall mail such nomination back to the Nominating Committee no later than the end of April. The Nominating Committee shall then prepare a slate of no more than three and no less than two names for each position according to the response of the members.

Section 3. Voting Process.

The President shall appoint two scrutineers (who shall not be eligible to run for office) to supervise the vote. Voting shall be by secret ballot, with each member casting one vote. Proxy votes may also be voted by the bearer. A majority of the vote cast is required to declare a winner. In the event that three contestants divide the vote such that none has a simple majority (50% + 1) then the name with the lowest vote count shall drop out, and a second vote will take place between the remaining two contestants. The order of elections shall be: President; Vice-president; Secretary; Treasurer.

Section 4. Acceptance of Nomination.

Those members nominated shall be asked whether they will accept or decline the nomination. If this leaves only one nominee remaining, then further nominations from the floor shall be accepted. A member need not be present in order to run for office, provided he/she has indicated in writing to the President that he/she will accept the position, if elected.

Section 5. Change of Executive.

The new executive shall take office at the conclusion of the General Meeting.

Article VIII. COMMITTEES

There shall be five permanent committees of the Society and other standing or ad hoc committees may be appointed by the Executive as required.

Section 1. Executive Committee.

The Executive Committee shall consist of the President, the Vice-president, the Secretary, the Treasurer and the Journal Editor. They shall be responsible for the general running of the Society and ensure the various sub-committees perform their duties.

Section 2. Membership Committee.

The Membership Committee shall consist of the Vice-president (chairman), the Treasurer and each regional representative. Regional representatives shall be appointed by the Executive, and shall assist in the recruiting of members and the collection of dues in their own area of responsibility. The current regions with representatives are: U.S.A., Canada, Europe and Australia. This committee shall receive all applications for membership, remit dues to the treasurer and maintain a list of members.

Section 3. Nominations Committee.

This Committee shall consist of four members at large, appointed by the Executive. They shall be responsible for preparing nominations for the next biennial meeting, as described in Article VII.

Section 4. Journal Committee.

This Committee shall consist of 3 - 4 members appointed by the Executive to assist the Journal Editor in reviewing all articles and papers submitted for publication. It shall be their responsibility to ensure that all such submissions meet with current standards for Scientific Journals.

Section 5. Conference Planning Committee.

This Committee shall consist of 4 - 6 members at large appointed by the Executive. Responsibilities would include:

a) Solicitation of possible future venues.
b) Establishment of a standard format for meetings.
c) Establish guidelines on the following:
   Financial aid to participants
   Honorariums to speakers
   Differential prices for members/non-members
   Distribution of profits
   Financial backing of the Society
   Expenses of those with large displays
d) Any other matters pertaining to the organization of the Conference.

Article IX. AMENDMENTS

The Bylaws of the Society not embodied in the Letters Patent may be repealed or modified by a bylaw enacted by a majority of members present at a General Business Meeting, provided that notice of motion of such change be sent to all members at least 60 days prior to the Meeting.

Article X. SEAL

The Society shall have an official seal which shall contain the words: "International Society for Plastination".

The seal shall be in the custody of the Secretary of the Society.

Article XI. APPROVAL OF ARTICLES

These articles became binding and effective when they were duly accepted by the eligible voting membership at the Fourth Biennial Meeting of the International Society for Plastination in Graz, July 28, 1994.

4TH BIENNIAL MEETING OF THE INTERNATIONAL SOCIETY FOR PLASTINATION

MINUTES

Date: July 27, 1994
Time: 17.00 - 19.00 hour
Place: Lecture hall of the Anatomical Institute, Graz, **AUSTRIA**, Europe

Agenda:
A) Welcome and establishment of the quorum
B) Approval of the agenda
C) Election of host for the 8th International Conference of the ISP in 1996
D) Bylaws and Constitution
E) Election of officers
F) Nomination of distinguished members
G) Plastination Certificate
H) Membership dues

1) The quorum was established

2) The agenda was approved.

3) The host site for the 8th International Conference on Plastination and the 5th Biennial Meeting of the International Society for Plastination, Brisbane, **AUSTRALIA**, was chosen by an overwhelming majority. The alternate host site, Columbus, **OHIO**, agreed to host an interim Conference in 1995.

4) The bylaws and constitution of the ISP were discussed. It was decided that the journal editor should be elected in 1996 for a 4 year term. An editorial board should be appointed by the editor at that time. Finally, the bylaws and the constitution of the ISP, including the above mentioned change, were accepted by unanimous vote.

5) Election of officers from the prepared slate of candidates: President - R. Henry, M. Lischka: Vice President - P. Arnold, K. Oostrom, D. Ulmer; Secretary - A Weiglen; Treasurer - R. Wade, B. Wise: Editor to be elected in 1996; Assistant Editor -G. Grondin, W. Lyons.

Results: President - Robert Henry; Vice President - Karine Oostrom; Secretary - Andreas Weiglein; Treasurer - Ronald Wade; Current Editor Dale Ulmer until 1996; Assistant Editor - Wayne Lyons.

6) According to article IV/4 ISP, Dr. Gunther von Hagens and Dr. Harmon Bickley were elected distinguished members of the ISP.

7) Plastination certificate: The establishment of a "Certificate in Plastination" was suggested by Dr. von Hagens. Possibly two categories: "Fellow of Plastination" and "Master of Plastination". The "Fellow" should be a user of one or more of the basic techniques. The "Master" must be a user of all plastination techniques. A committee should be appointed to establish guidelines and judge the applications for such certification.

8) The annual membership dues were fixed at USD 45. All members of the ISP will continue to receive the Journal of the ISP free of additional charge. The printing costs for the Journal with only black/white prints is about USD 1,200. The printing cost for the journal with color prints is about USD 300 additional per page of color. Color costs will continue to be paid by the author.

The use of corporate advertisement was suggested by Art Rathburn. He and Wayne Lyons agreed to follow up on this matter.

The possibility of exceptions concerning membership dues, according to financial circumstances, was moved and seconded by K. Oostrom and R. Wade and accepted by unanimous vote.

Respectfully submitted:
Andreas H. Weiglein, M.D.
Secretary of ISP

A BRIEF CHRONOLOGY OF INTERNATIONAL HAPPENINGS IN PLASTINATION

Harmon Bickley
Mercer Univ., Macon, Georgia.

The International Meetings

Many of us attending this meeting have been plastinating for some time now, so it might be interesting to briefly glance back and see how far we've come. Note that I am not dignifying this report by calling it a history. The history of international plastination is an important story that needs telling, but it will take far more effort and space than we are using here.

Let's begin with what we are calling (in retrospect) the "First International Conference on Plastination."

1. The "First International Conference on Plastination" was actually entitled "Preservation of Biological Materials by Plastination." It was convened in San Antonio, Texas, USA on Friday, April 16, 1982 and lasted only one day. Eighty people were registered, all from the United States. It wasn't very formal and it really wasn't international. But we're counting it anyway.

2. The "Second International Conference on Plastination" was held in San Francisco during April of 1984. It seems that it was hardly more formal than the first, since my files contain no examples of brochures or other mailings. As I remember, the attendance was close to 100 and even included some from outside the U.S. The need for this kind of conference expressed by those in attendance, encouraged us to do a better job on the next one.

3. The "Third International Conference on Plastination" was held in San Antonio, April 21-25th, 1986. It was publicized widely in both North America And Europe, therefore we anticipated a strong response. As a result, attendance was excellent and the meeting finally began to take on an international character. With this conference, the current five-day format was adopted: two days of lectures dealing with the principles of plastination, one day of informal gatherings, and two days of papers relating to advanced topics. It was at this meeting that the International Society for Plastination was founded and plans were made for publication of the journal. Volume 1, Number 1 of the Journal of the International Society for Plastination was released in January of 1987, and contained many of the papers presented at this meeting.

4. The "Fourth International Conference on Plastination" was held at Mercer University School of Medicine, Macon, Georgia, USA, March 21-25th, 1988, again employing the current five-day format. Judging from both attendance and comments, it was a resounding success.

5. The "Fifth International Conference on Plastination" was one of the highlights of our brief history. It was particularly significant since it was held in Heidelberg, the "Birthplace of Plastination." The dates were July 22-27, 1990, a change from the usual springtime interval. It was well publicized throughout the world and attendance was the best ever.

6. The "Sixth International Conference on Plastination" was held at Kingston, Ontario, Canada in 1992. Again, July dates were used since this seemed to accommodate those of us who had teaching duties. The meeting was thoroughly enjoyable and introduced many new people to plastination.

7. And here we are at Graz for the "Seventh International Conference on Plastination in 1994." We couldn't have chosen a nicer place to meet, so this is bound to be just another great meeting.

(Editors Note - It Was!)

INTERIM MEETINGS

Interim meetings (those held during the off-year intervening the International Conferences) popped up quite spontaneously. The initiative for holding

them was provided by members who wanted an opportunity to serve as a host. They have been held at a number of interesting places such as Knoxville, Tennessee, Rancho Cucamonga, California, and Mobile, Alabama, all in the United States.

Although not advertised as international meetings, they have gradually become quite international in composition. They tend to emphasize the "hands-on" rather than the didactic approach.

THE INTERNATIONAL SOCIETY FOR PLASTINATION

As mentioned above, the International Society for Plastination was organized at the Third International Conference on Plastination. It was conceived as a means of defining plastination as an area of professional activity and serving as an agency for disseminating information relative to the art and science of plastination. It's role was envisioned as consisting of five principal services:

1. To identify an international community of scientists and technologists interested in plastination.

2. To serve as a form for the international exchange of information about plastination through the periodical publication of a journal.

3. To organize and conduct regular regional and international workshops and meetings.

4. To maintain an international registry of laboratories and technologists skilled in the performance of plastination.

5. To define plastination as an area of professional activity and provide a means of learning and practicing plastination as a career.

Well, that's the whole story in outline. As you can see, we've come a long way since the first silicone elastomer was forced into a specimen. Our organization has been simple and pragmatic, by intention. But perhaps it is time for the International Society for Plastination to become more of a broadly based membership organization and climb to even greater heights. This was proposed at the Business Meeting and officially adopted.

Festivities at "Landhaus"

PRINCIPLES OF PLASTINATION - SPECIMEN PREPARATION

Robert W. Henry,
College of Veterinary Medicine,
The University of Tennessee, Knoxville, TN, USA.

The concept of plastination is: Replacing tissue fluid with a curable polymer. This is accomplished by removal of tissue and fixation fluids with a dehydrating fluid; subsequent saturation with a volatile intermediary solvent; and finally exchange of the volatile intermedium with a curable polymer. "Specimen preparation" is an extremely important part of the plastination process. If the specimen is not prosected and presented in a manner which will highlight the desired structure of the specimen, it may not be as useful as was intended. It is important to first plan what pertinent structures of the specimen are to be demonstrated and then prosect it accordingly. A typical fault of prosections is attempting to preserve too much detail. Hence, the final product appears cluttered. Therefore, it may be best to highlight only the more pertinent structures to carry out the theme of the specimen. Vessels may be highlighted with colored latex, epoxy (Biodur E20), silicone, or gelatin. Excess connective tissue should be removed from nerves, vessels and other delicate structures. Muscle groups should be well-defined and cleaned of excess connective tissue. Consider removing periosteum from bone preparations. Hollow organs should be dilated to an appropriate diameter using water and then should be emptied of their contents. Emptying intestinal specimens of their

Society Treasurer (Ron Wade and Lady) ponder conference

contents is facilitated by making an incision in the organ. After the contents are evacuated and the organ is flushed, the incision may be closed using suture and the organ redilated to the desired volume with a low percentage formalin solution. Over-dilation produces a more flexible intestinal preparation. However, over-dilation will decrease inner surface detail, e.g. mucosal folds may be lost. Both fixation time (1-3 days) and concentration of solution (1 - 5% formalin solution) should be minimal. After fixation, the fixative is washed from the specimen using running tap water. Once the specimen has been rinsed of the fixative, it is ready for dehydration. Stained specimens may be brightened using a 0.5% to 3% hydrogen peroxide solution prior to dehydration. Freeze/fixation may be used and is especially helpful to preserve specimen color and shape. Formalin (5%) [stabilized with 105 Methanol] is placed in acetone for freeze fixation. This acetone-formalin solution also serves as the first acetone (dehydration) bath (95% acetone). After one week of fixation/dehydration, dehydration is continued by transferring the specimens into new acetone.

PRINCIPLES of PLASTINATION - GAS CURING (HARDENING)

Robert W. Henry,
College of Veterinary Medicine,
The University of Tennessee, Knoxville, TN, USA.

Curing or hardening of the polymer varies for each polymer used. This paper will reference only the standard silicone procedure. After impregnation of the specimen with the polymer-mix, the polymer must be hardened. First, the excess surface polymer is allowed to drain from the specimens and this polymer is returned to the vacuum chamber for reuse. For the S10 process, **Gas Cure with Biodur SH06** is the hardening agent. S6 is a liquid which vaporizes and reacts with the polymer and commences the process of side-to-side linkage of the polymer molecules. Side-to-side linkage produces a stronger product. Curing commences on the surface of the specimen and proceeds to the interior of the specimen. Two curing procedures have been used over the years. **Slow cure:** the specimen is held at room temperature for several weeks prior to exposure to S6 and excess polymer is blotted from its surface. Room temperature enhances S3 activity and hence end-to-end linkage occurs, which hopefully, produces a more flexible specimen. Exposure to heat (60°C oven) may also be used with this methodology. Slow cure is an older methodology and is still used, but is not necessarily a procedure of choice. The other procedure is: **Fast cure**: the impregnated specimen, shortly after impregnation and draining of the excess polymer, is exposed to a concentration of S6 vapor. In a few days, the specimen is nearly cured and may be used. Volatilization of S6 may be enhanced by bubbling air through the liquid S6. The environment for the gas cure should be dehumidified via a desiccant (calcium sulfate). An increase in humidity, in the curing chamber, may cause white silicate salt precipitation on the surface of the specimen. During fast cure, to avoid hardening of oozing polymer on the surface of the specimen, specimens should be manicured twice daily until the surface polymer has hardened. Hollow specimens should first have air blown into their lumens to void them of pools of polymer and to inflate them to their normal contour. For curing, a concentration of volatilized S6 can be directed into their lumen to assure that the organ is cured in a dilated position. Both the slow and fast cure methods utilize Biodur S6. Exposure to the curing agent (S6) is carried out in a closed chamber at room temperature. Exposure of the specimen to S6 produces a hardening of the surface polymer in the specimen after 12 to 36 hours. However, the interior of the specimen will take longer to harden and is dependent on the S6 penetrating to the depths of the specimen. The specimen may be used before deep curing has been completed. After curing is complete, the specimen can be stored indefinitely at room temperature.

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

To this end the Anatomy Department of the 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

R. Olry, G. Grondin Univ. de
Quebec Trois-Rivieres, Canada.

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.

W.F. Pretorius and T.S. Lessing
Dept. Anatomy and Cell Morphology,
Univ. Orange Free State,
Republic of South Africa.

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

Munari P.F., De Caro R., Carlesso G.
Sgambati E., Brizzi E.
Institute Anatomy, Padova, Italy, Dept.
Anatomy & Histology, Univ. Firenze, Italy.

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

K S Satyapal and G Mathura
Dept. Anatomy, Univ.
Durban-Westville, S. Africa.

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

K S Satyapal and G Mathura Dept. Anatomy, Univ. Durban-Westville, South Africa.

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

G.M. Sprinzl, E.R. Brenner, W.F. Thumfart, W. Platzer University of Innsbruck.

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

B. Szarvas, L. Szaraz, P. Groscurth
Institute Anatomy, Univ. Zurich-Irchel.

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

K. Tiedemann, Heidelberg
Institute of Anatomy and Cell Biology,
Heidelberg, Germany.

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

Jinghua, Zhang; Yoshida, Y.; Yoiiro, T.
Dept. of Anatomy, Univ. Tokyo, Japan.

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 IIei (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

Wolfgang Weber
Iowa State University, Ames, Iowa

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

Dr. Tian Zhong Zheng Univ. of Iceland-Reykjavik, Iceland.

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.

PRINCIPLES OF PLASTINATION - DEHYDRATION OF SPECIMENS

Robert W. Henry
College of Veterinary Medicine,
The University of Tennessee,
Knoxville, TN, USA.

Specimens to be plastinated are often moist which necessitates the removal of tissue fluid **(dehydration)** before forced impregnation or plastination can be carried, out. Dehydration removes the specimen fluid (water), as well as, some fat. The tissue fluid is replaced with an organic solvent. To be a dehydrating agent, the solvent must be miscible with water and may consist of a variety of chemical structures (ketones or alcohols). Either alcohol or cold acetone may be used as a dehydrant for plastination. Methylene chloride (chlorinated hydrocarbons) is not a dehydrating agent. Shrinkage accompanies dehydration and may be minimized by: 1) using cold acetone (known as freeze substitution) or 2) starting dehydration in a lower % of ethanol. With freeze substitution, the ice in the specimen is replaced by the dehydrating liquid (acetone). It is essential to use an adequate volume of dehydrating liquid (either cold acetone or ethanol). The recommended ratio is: 10 volumes of dehydrating fluid to 1 volume of tissue. It is necessary to monitor the concentration of the dehydration fluid at weekly intervals. Once the fluid content has remained similar for a few days, the specimen is moved to a fresh dehydrating solution. **Cold ACETONE** (**-15° to -**25°C): usually has been considered the best method of dehydration. However, dehydration with acetone must be carried out in the cold and not at room temperature; warm acetone will cause excessive shrinkage and complete dehydration may not occur.

Disadvantages: must be done in a deep freezer and acetone is a hazardous material.

Advantages: Minimal shrinkage; Acetone serves as the intermediary solvent; Superior specimens are produced; Dehydration time is shorter and previously used acetone (70% - 90%) maybe used to commence dehydration. **ETHANOL:** Specimens are started in a low % of room temperature ethanol (50%), allowed to equilibrate and later placed in ascending concentrations of ethanol, ie: 60%, 70%, 80%, 90%, 100%. Carried out at room temperature; therefore, less deep freezer space is necessary. Specimens can be stored in 70% ethanol. Specimens from embalmed tissues, containing standard embalming fluids, are cleansed of the polyvalent alcohols (glycerin or ethylene glycol) or phenols. Specimens are defatted.

Disadvantages: excess shrinkage and the dehydrated specimens must be saturated with intermediary solvent [acetone or methylene chloride (dichloromethane)]. Why? The saturated vapor pressure (boiling point) of ethanol is too low to be slowly extracted at -15°C and allow concurrent influx of the silicone polymer. As for the choice of intermediary solvents, methylene chloride may be more cost and time efficient, but it is more hazardous. An inherent problem with using acetone is that the specific gravity of ethanol and acetone are similar (0.79) making it difficult to determine when the ethanol has been totally replaced with acetone. When specimens are totally dehydrated they are ready for impregnation with the silicone polymer mixture.

RECLAMATION of ACETONE by FREEZE VACUUM DISTILLATION

Janick, L.M. and R.W. Henry,
College of Veterinary Medicine
The University of Tennessee, Knoxville, USA.

SUMMARY

Reclamation of large volumes of acetone by freeze-vacuum distillation was practical, simple, economical to perform, and environmentally wise. The apparatus, constructed primarily from items found within a plastination laboratory, proved to be effective for the distillation of the various percentages (45 - 94%) of acetone used for conducting this study. Three liter aliquots, of known acetone content, were distilled over a six hour period and resulted in reclamation of 94 to 98 percent acetone. Further distillation, of the remaining lower percentage acetone (2 - 20%), provided residual solutions to as low as 1 percent acetone. Freeze-vacuum distillation has served to

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reduce operating costs both by reclamation of large volumes of quality acetone and significantly reducing the volume of hazardous waste which must be disposed.

INTRODUCTION

An integral part of the plastination process is dehydration of specimens, a process which exchanges tissue fluid (water) and excess fats with an organic solvent. Cold acetone (-25°C) is usually the best solvent for dehydration (von Hagens, 1986; Henry, 1992). This process, however, leads to an accumulation of waste acetone (contaminated by water and fats) which necessitates not only the purchase of new acetone, but the disposal of the old acetone as a hazardous waste. Although previous work has characterized methods for effectively distilling acetone (Roark, 1992; Grodin and Bèrubè, 1992), the practicality of freeze-vacuum distillation for both large volume applications and significant reduction of hazardous waste has not been addressed.

MATERIALS and METHODS

(1) Nalgene 114 L. (30 gal.) tank (60x60x30cm.) Nalge mfg. # 141000021
(1) Large Pyrex dessicator I.D. flange 250mm with a 55/38 sleeve Corning mfg. #3120250
(2) 5 meter Rolls of 6mm O.D. copper tubing
(1) Needle valve (HI14, Biodur)
(1) Nalgene polyethylene vacuum tubing
(1) vacuum gauge reading inches of Hg
(2) Bi-vented 2 liter cylinders fabricated from 18 gauge stainless steel
(1) vacuum pump
(10) medium size rocks
(1) Sub zero freezer

Prior to distillation, fat was removed from waste acetone by freeze separation (Grondin and Bèrubè, 1992). A three liter aliquot of the waste acetone (45 to 94 percent) was placed into a dessicator along with 10 medium size rocks. The rocks served as a bumping agent to catalyze the vaporization of the acetone. The dessicator and acetone were warmed in a 40°C water bath (Nalgene tank). Vacuum was applied, increased until the acetone boiled (19 to 25 inches of mercury), and then stabilized by adjusting the needle valve. As vacuum increased, the liquid acetone vaporized and flowed, via polyethylene tubing, to a copper condensing coil in -15°C freezer. The combination of warming the liquid waste acetone and applying vacuum facilitated the vaporization of the acetone in the dessicator. With the subsequent chilling of the vapor in the condensation coil, much of the acetone returned to the liquid state and collected in the first canister. Any remaining acetone vapor passed through the second copper condensing coil and most of any remaining acetone was collected in the second canister. The system concluded with the vacuum line coursing from the second canister, out of the freezer, to an elevated vacuum pump. A needle valve, for vacuum regulation, was placed in this line. Each 3L aliquot of waste acetone was distilled for a six hour period. Reclaimed acetone was collected at 2 hour intervals. Subsequent to each collection, the vacuum was re-applied to a level sufficient to promote further boiling.

RESULTS

Reclaimed acetone (over 6 hour periods) was collected with purities reaching 98 percent from the higher distillates to 94 percent from the lower distillates (Table 1). Maximum volume loss for this operation was maintained at or below 4 percent indicating a fairly efficient system. Residual waste products ranged from 20 to 2 percent in a corresponding fashion. Further distillation of small quantities of low percentage acetone was not efficient. However, distillation of cumulative solutions (3 liters of 2 to 20% acetone) did prove effective for reducing the percentage of acetone to near 1 percent. Depending on local restrictions, this concentration (1%) of acetone may be easily disposed. Even if disposal as a hazardous waste is required, the overall quantities become considerably reduced (Table 1). Therefore, this procedure reduces the cost of waste disposal and reclaims large volumes of acetone for re-use in the dehydration process.

ACKNOWLEDGMENTS

We gratefully appreciate the assistance of the university of Tennessee College of Veterinary Medicine Art Department: Debbie Haines and Kim Cline.

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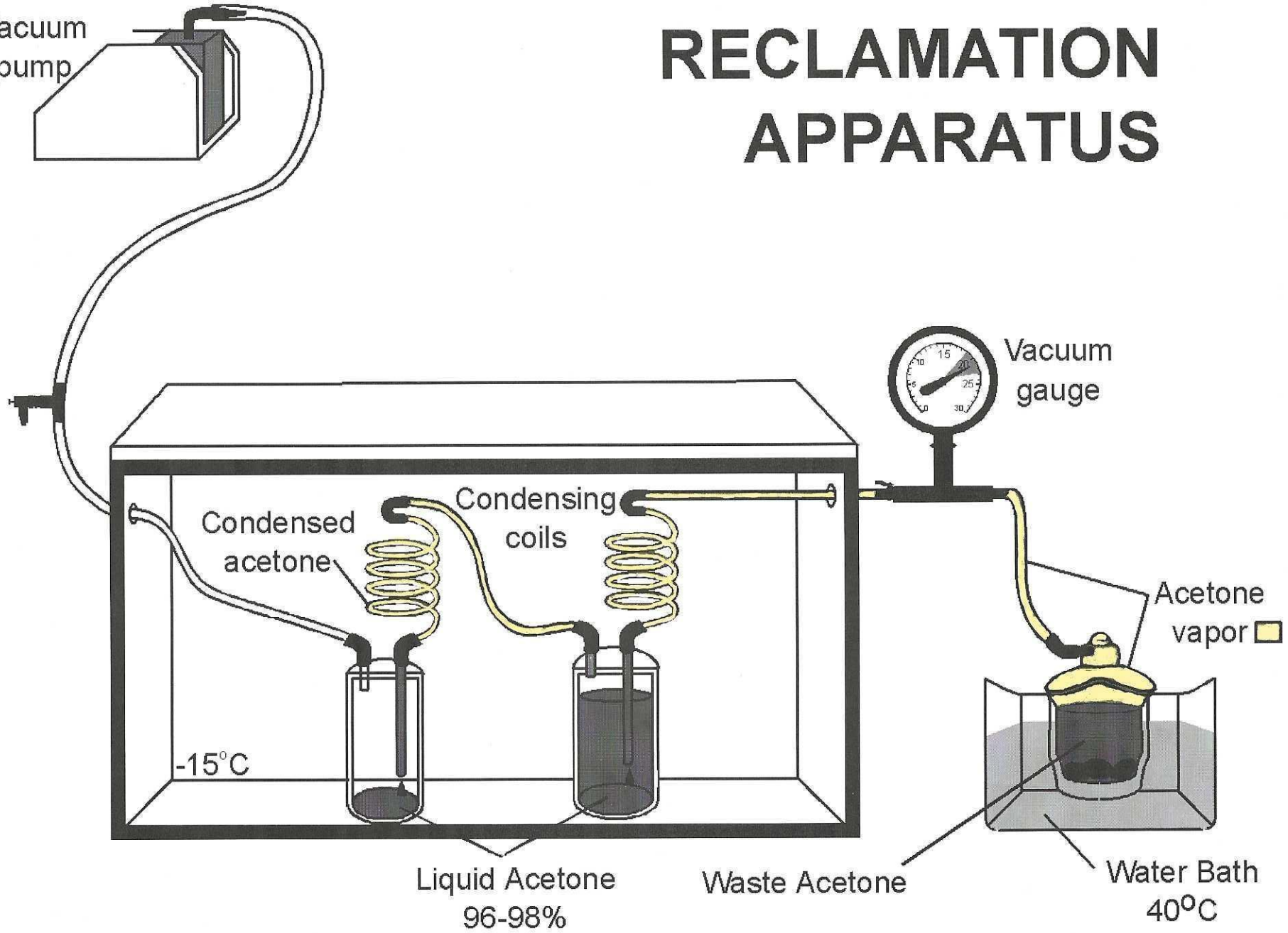
Table 1
3 Liter Distillations - Varying % Acetones

% Acetone	Total Volume Collected	Total Volume Remaining	Total Volume Lost	Volume lost % of total
94%	2580 ml 98% Acetone	300 ml 20% Acetone	120 ml	4%
87%	2425 ml 97% Acetone	460 ml 14% Acetone	115 ml	4%
70%	2000 ml 97% Acetone	900 ml 10% Acetone	100 ml	3%
58%	1370 ml 95% Acetone	1370 ml 5% Acetone	80 ml	3%
45%	1220 ml 94% Acetone	1760 ml 2% Acetone	20 ml	1%

RECLAMATION APPARATUS



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ABSTRACT

THE USE OF SILICONE PLASTINATED SPECIMENS FOR LIGHT AND ELECTRON MICROSCOPY

Gilles Grondin, Gilles G. Grondin[1]
and Brian G. Talbot
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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, plastinated specimens 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.

Gilles Grondin, Gilles G. Grondin and Brian G. Talbot: A study of criteria permitting the use of plastinated specimens for light and electron microscopy. Biotechnic and Histochemistry 69(4)1994.

Countries Cross Paths

If you can find mistakes in this publication, please consider they are there for a purpose. We publish something for everyone and some people are always looking for mistakes.

AN ALTERNATIVE METHOD OF INJECTING EMBALMING FLUID AND LATEX, IN PREPARATION FOR PLASTINATION

WF Pretorius.
Dept. Anatomy and Cell Morphology,
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We are all familiar with the fact that, provided there is no obstruction in the blood vessels, the embalming fluid circulates readily and infiltrates the tissue of the cadaver. We attempted different entrances into the blood circulatory system to find an easy and uncomplicated method, which would not disturb important anatomical areas and one that could be performed by persons with little or no knowledge of anatomy.

Traditional embalming methods include intra-arterial injection into the carotid or femoral artery, as well as intracardiac injection. All these methods, even when correctly executed, have certain disadvantages.

An intricate procedure is required when using the carotid or femoral arteries because a reasonable knowledge or experience of these areas is necessary. Further, there are, in both cases, structures that could be damaged. In both cases there are large adjacent veins which could be punctured, with the result that blood and embalming fluid leak out. These arteries are deeply situated and therefore require longer skin incisions to insert the tiedown strings. Two cannulae have to be introduced, one distally and one proximally, due to too small anastomoses. Such an incision is often a cause for the disturbance of the relationship between different anatomical structures.

The most significant advantage of the method of embalming under consideration, is the use of larger blood-vessels which decreases the time-span required to complete the process. In those instances where the carotid artery is used, the brain can be fixated with formalin, prior to the embalming process, without having to drill a hole into the skull for the injection of formalin.

Intra-cardiac injection appears to be an easy method which apparently does not disturb the anatomy of the cadaver. Our experience indicates that considerable experience is required to insert the needle correctly into the left ventricle. In practice it often occurred that the needle was inserted laterally of the left ventricle or right through it into the pleural cavity.

Although the cadaver was infiltrated adequately with the embalming fluid, the lungs, heart and blood vessels were totally compressed.

Another disadvantage is the unnecessary loss of embalming fluid through the mouth. In the case of intra-arterial methods, the aorta valves function without the use of muscles, and prohibit the reflux of embalming fluid via the lungs and trachea through the mouth. However, in the case of the intra-cardiac method into the left ventricle, muscular action is required for the actions of the valves between the left atrium and the left ventricle to prevent the reflux.

The embalming method which best suits our needs, is the intra-arterial injection into the radial artery. The position thereof at the radial pulse can even be determined by untrained staff. Only a slight skin incision is required to insert a small canula proximally into the artery. The same artery can, at a later stage, be used for latex injection. Approximately 550 cadavers have been embalmed by this method and in only one case was this method unsuccessful. This was due to a radial artery which was exceptionally small in diameter, most probably a congenital abnormality. The only significant disadvantage of the radial arterial injection, is that it takes $\pm$ 4 hours to complete. Instead of 2 hours as is the case when compared to femoral or carotid artery injection.

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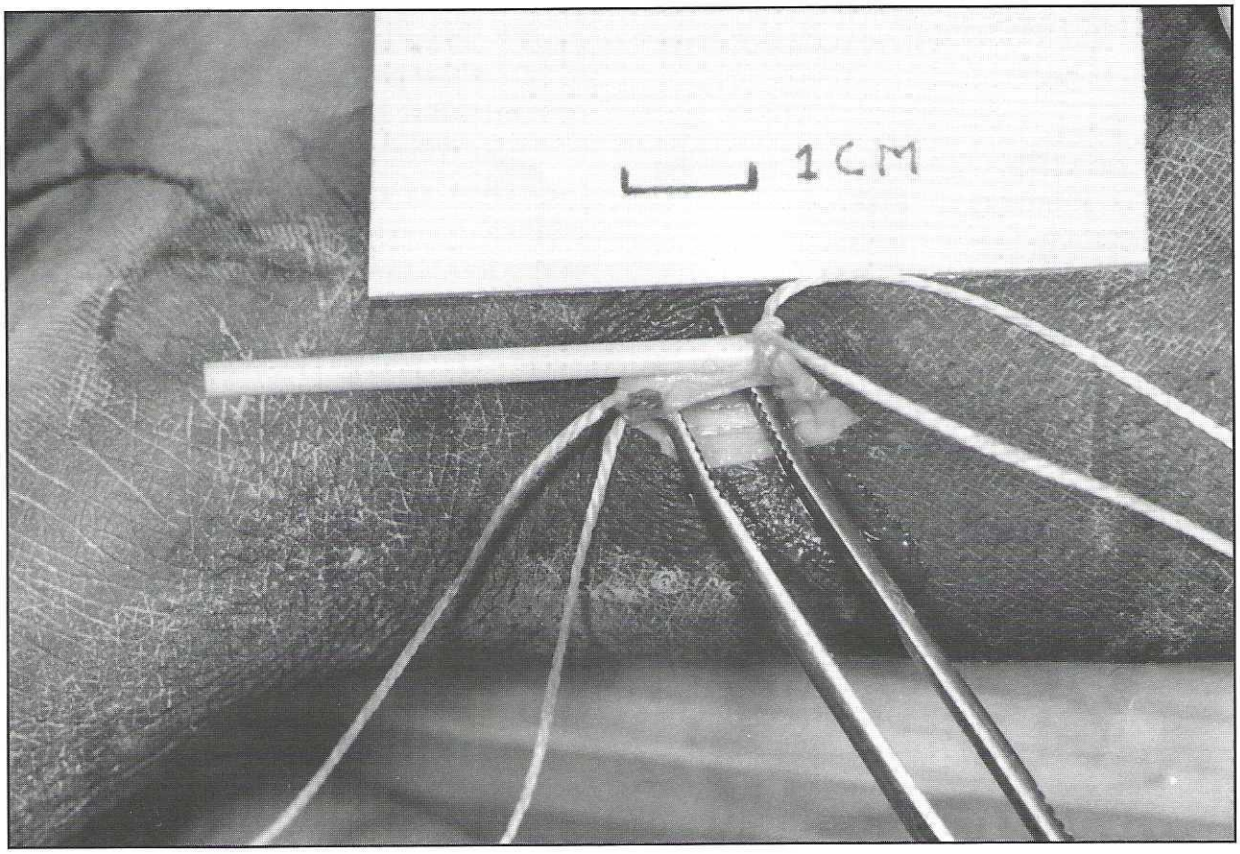

A cannula is inserted into the radial artery. Distal to the cannula the radial artery is sealed and embalming fluid reaches the hand via the ulnar artery.

FORMULA FOR EMBALMING OF CADAVERS FOR STUDENT DISSECTION AND THE MODIFICATION THEREOF FOR PLASTINATION

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The addition of plastination of biological material to the list of preservation techniques, has necessitated the development of revised fixation techniques, over and above those already known in our field.

A standardized formula for embalming is used at the UOFS for the embalming of those cadavers which are to be used by students for dissection. This formula has proven to be successful, as no fungal growth has appeared on our cadavers.

The recipe is as follows:

Recipe 1 96% Ethanol -12 L
Formalin Glycerin - 500 ml
Water - 750 ml
80% Liquid Phenol - -3.5L 500 ml

Modified Embalming Formula for Plastination and Serial Body Sections.

Recipe 2
96% Ethanol -28 L
Formalin -1.2 L
Glycerin -0.8L
Water -8L -
Phenol 1.2 L

This formula is injected into the radial artery under pressure of 1 -1.5 kilopascal, until the cadaver is filled (± 25L for a 60 kg cadaver). The blood flows into the veins and the arteries are therefore empty, allowing the subsequent red Latex-injection.

The injection of Latex should be done after a minimum of 5 weeks following embalming. By then the arteries have almost emptied of embalming fluid and as a result lower concentration of phenol, which causes congealment of Latex, is present. Before Latex can be injected, it should be preceded by an injection of 20ml of 25% ammonia solution, and then followed immediately by 750ml injection of Latex. The pH of these embalming formulae are acidic as Latex does not coagulate in an alkaline medium. A red colorant, Rubine Toner, at a ratio of 6-1 is used. With the advent of radiotomography and the requirement for material which had been plastinated, it became necessary to revise the formula. Cadavers were embalmed at a lower pressure of ± 1 pascal, using approximately 5 litres less embalming fluid and after injecting latex, it was allowed to congeal before proceeding with slicing or dissection.

This formula contains less glycerin, but has the benefit of making the tissue firmer. It is our opinion that the presence of glycerin and ethanol in the formula provides excellent retention of color, as well as providing the additional benefit of allowing the tissue to be frozen much harder for a more precise slicing process.

To prepare for slicing the cadaver is placed in a freezer and after +/- 3 days, dry ice is added for +/- 12 hours. Following this the slices can be cut. Pine oil, which was previously used in our formula, was excluded, as it left a residue in the acetone bath. It also had an adverse effect on the distillation process of acetone.

Wet specimens, cadavers and previously dissected sections can easily deteriorate into dried specimens if they are manhandled by students or inexperienced staff. Continuous and correct management of specimens with proper use of moistening solutions is essential.

As a result it is important to evaluate the specific properties of chemicals used in embalming or moistening solutions. When assessing embalming formulae it must be noted that they are comprised of a number of chemicals, each with its own function.

When a previously embalmed cadaver was being dissected and the tissue was exposed to air, a significant change in volume was noted in the tissue. It maybe surmised that the continued use of certain chemicals (humectants and bactericides) are essential, whereas the purpose of some of the fixatives (eg. alcohol, pine oil, and formalin) have been served during the embalming process, and these need not be supplemented or monitored for when working with exposed tissues. However, it is absolutely essential for wet specimens to be kept moist. Routinely, we cover these with cloth dipped in suitable wet fluid, after which they are covered with polyethylene bags and stored in a cooled room. When wet specimens are in use and are required to be uncovered for longer periods, they are moistened with fluid using an ordinary domestic spray can. Subsequent to such exposure, these specimens are dipped in suitable specimen wetting fluid.

The formula of the wetting solution which is used, is as follows:

glycerin - 250 ml
80% liquid phenol - 250 ml
make up with water to 1 litre.

This formula is standardized and not the only one used by people working in this field.

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Breaking News:

During the Italian Society of Anatomy meeting, October 4,1994, the Faculty and Staff at the three plastination laboratories in Italy were recognized as a specialty section. The purpose of the group is to spread plastination technology in Italy. Plastination laboratories are currently operating at the Universities of Florence, Padua and Rome. This plastination group met November 8, in Florence and elected Professor Enzo Brizzi as coordinator and Professor Ripani as secretary of the group.

THE USE OF E-20 RED RESIN FOR CASTING ANATOMICAL CAVITIES

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The first recorded example of the casting of anatomical cavities was that of Leonardo da Vinci (1452 - 1519). Molten wax was used to cast the ventricals of the brain. By doing so da Vinci developed a new dimension in the study of anatomical cavities by filling them with a solidifying agent.

Looking at Biodur E20 resin in comparison to wax, we find that they have common characteristics. They both solidify, but more important for the technician, is the fact that heat plays a role in the consistency of these products.

When cold, E20 has a high viscosity. At room temperature it has the consistency of honey and at 50°C it pours like water. Using this phenomenon one can inject micro anatomical cavities.

AIM:

The aim of this method is to produce a corrosion cast of the glomeruli of the kidneys of a rat.

METHOD:

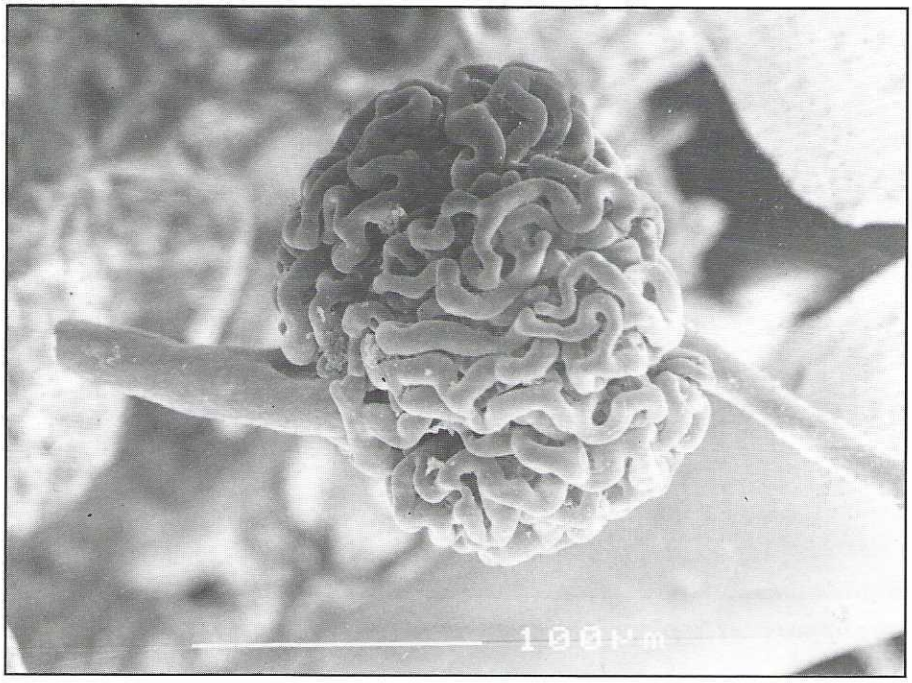
The abdominal aorta was blocked distally to the kidneys by tying surgical silk tightly around it. A canula was inserted into the thoracic aorta and the blood was washed out of the kidneys using saline solution with heparin.

The rat was submerged in a water bath at 50°C for ± 20 minutes. A beaker containing the E20 was standing in a water bath at the same temperature.

Injection of E20 was completed using a 10cc syringe (preheated) until the kidneys were visibly full. One important point to remember is that by heating the resin the setting time is reduced dramatically. No time should be wasted after mixing the catalyst with the resin. After curing of the resin the soft tissue was removed (macerated) with KOH (4%) and studied with a scanning electron microscope.

The glomeruli were completely filled with E20, and the arteries and veins were clearly visible.

In conclusion we found E20 resin an exceptionally suitable resin to study the ultrastructure of anatomical cavities.



A scanning elecyron micrograph of a glomerulus of a rat kidney filled with E20 resin. (X470)

MAINTAINING EXTENSION OF THE HAND DURING AND AFTER EMBALMING

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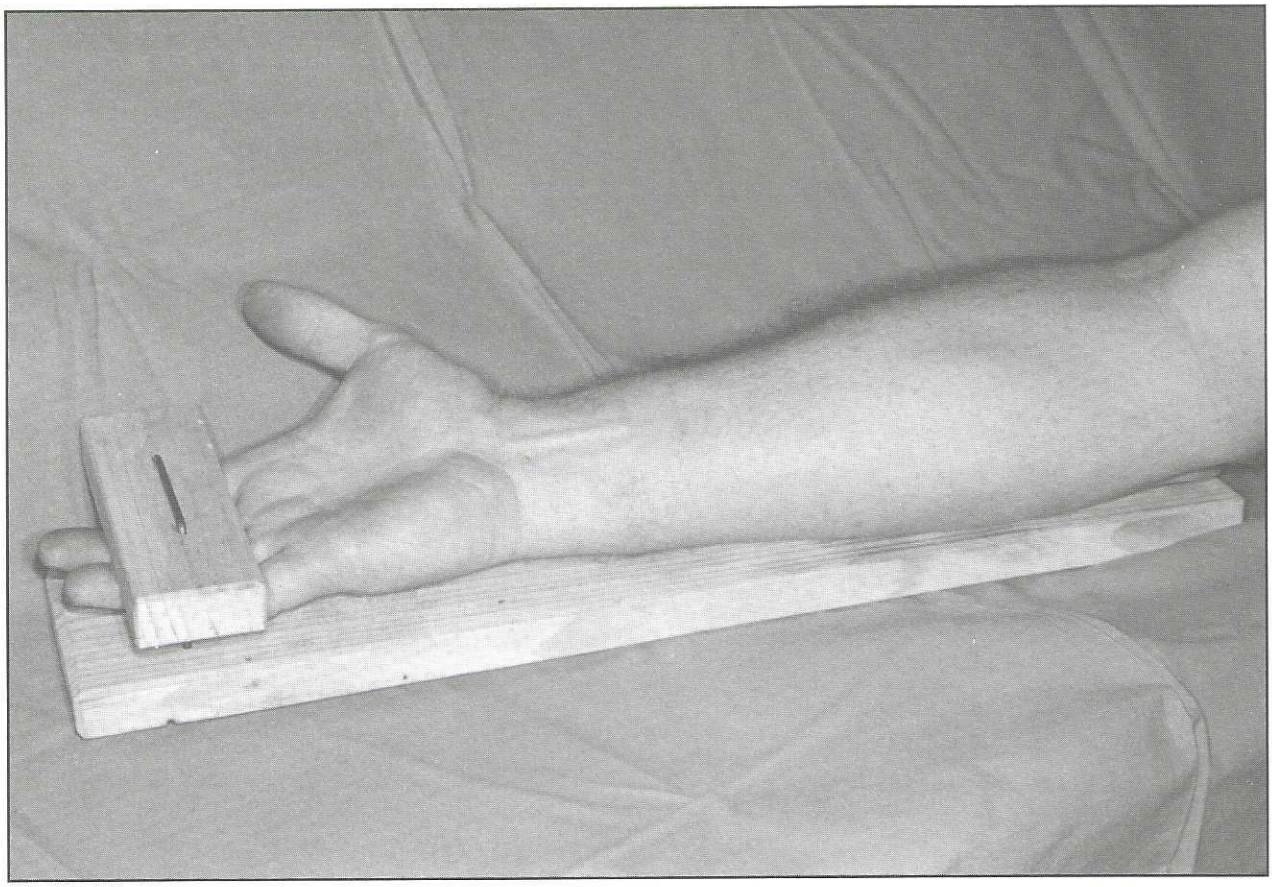
Dissection of the human hand is complicated when the hand is closed. It is a common phenomenon that the hand closes when death sets in. Even if it could be opened before the cadaver is embalmed, it does not remain in that position during embalming. This is the result of the contraction of the stronger flexor muscles due to the pressure of the embalming fluid.

To counteract this problem, we have designed a basic apparatus using wood, which maintains an open position of the hand during the embalming process. The fingertips are placed beneath the crossbar where the weight of the forearm of the cadaver keeps the apparatus in position. The embalming process can now proceed and the apparatus may be removed when this process has been completed.

The tendency of the flexors of the forearm to close the hand is no longer exhibited when the embalming process is completed. The hand remains open and it is quite convenient for dissection of the palm and fingers.

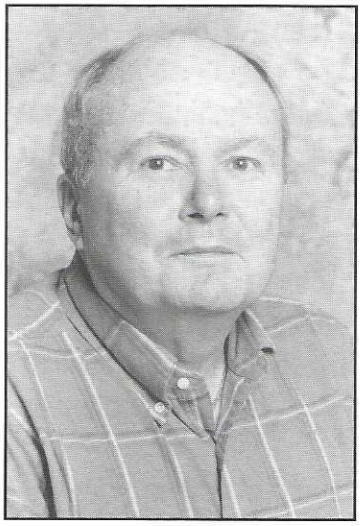


The weight of the forearm keeps the apparatus in place. The crossbar keeps the fingers straight until embalming process has been completed.

ISP PROUDLY RECOGNIZES:
DISTINGUISHED MEMBERS

Gunther von Hagens

Gunther von Hagens, inventor and first practitioner of plastination was born in eastern Germany. After an experience that would have discouraged most people, he made his way to Heidelberg, where he became a member of the faculty of the Institute of Anatomy of the University of Heidelberg. Interest in the preparation of better teaching specimens led to his discovery of techniques for the infusion of human tissue with curable polymers. This, in turn, resulted (1975) in his developing a range of standard procedures for the production of polymer-impregnated specimens. One evening, while discussing his recently acquired preoccupation with a friend, he decided to call the new technology, "Plastination." Once introduced to the academic public through conferences and workshops, plastination became a universally accepted adjunct in the teaching of anatomy and pathology. It is now practiced around the world and continues to find new uses in both teaching and research.



Harmon Bickley

Harmon Bickley was born in Detroit, Michigan USA. He began his teaching career as an Assistant Professor of Pathology at the University of Kentucky Health Science Center in Lexington. From there he became a member of the faculty at the University of Iowa, College of Medicine and was later appointed Professor of Pathology at the University of Texas Health Science Center at San Antonio. He is presently Professor of Pathology at Mercer University School of Medicine, Macon, Georgia. While at San Antonio, he went to Heidelberg to learn a startling new technique for the preservation of teaching specimens. (December, 1979.) Returning to San Antonio, he established the first American (medical school) laboratory for the production of plastinated teaching specimens and organized a series of international conferences on the subject. He convened the first meeting of the International Society for Plastination and edited the first issues of its journal.