ESTABLISHING AND OPERATING A PLASTINATION LABORATORY AT THE INSTITUTE OF ANATOMY, UNIVERSITY OF VIENNA

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THE INSTITUTE OF ANATOMY

The Institute of Anatomy, University of Vienna is a renowned European institution. Its history is associated with many important names in the field of Anatomy such as Joseph Hyrtl, who not only elevated the study of human and comparative anatomy to a new standard of excellence but also was very active as a teacher and founder of our specimen museum.

Another outstanding anatomist in the history of the institute was Julius Tandler, author of a widely accepted four-volume textbook. Dr Tandler was also a famous politician. In addition to his contribution as a teacher and scientist, he was responsible for establishing an exemplary system of social welfare in Vienna in the early decades of this century. It is largely through his efforts that the institute became so well-accepted as a part of the community of Vienna.

Because Vienna was the capital of the Habsburg Monarchy, the Medical Faculty of the University of Vienna has always had to contend with large numbers of students. This was a problem in the days of Theodor Billroth and has persisted even to the present, but for other reasons.

Therefore, we are a large institution, consisting of three chairs in the area of research and teaching and a smaller unit that oversees the operation of the museum. This smaller unit also runs the plastination laboratory and is involved in other projects in medical education.

•The staff of the institute comprises three full professors, four positions equivalent to associate professor and approximately 20 • -full-time assistants, all holding medical degrees. In addition, a number of part-time appointments for medical doctors and 45 I<such positions for medical student tutors are available. We also < have a technical staff for research and administration, as well ^ as some 12 persons who work in the area of body conservation, | body storage and support of dissection courses.

All this is necessary to cope with classes numbering ^approximately 1200 students per year. Such a large student population requires a yearly intake of about 250 whole bodies, ^obtained through a well-functioning donation system, and ^approximately the same number received as autopsied corpses.

This sizeable effort enables us to provide our students with an intensive learning experience in topographical anatomy. Dissection courses are organized into groups of six students for each body and last for a total of 165 hours. As far as we know this is quite a good standard for anatomy courses offered within German-speaking countries.

Bodies for routine dissection are preserved in the conventional way by infusion via the femoral artery with a mixture of phenol and formaldehyde in deionized water. Final concentrations of both components are less than 1%. We emphasize the importance of using the gravity method and allowing the embalming fluid to find its own way, even when the embalming time is overly long. For routine storage, the bodies are placed on trays and maintained by an automatic system that sprinkles them several times a day with a phenol-free disinfectant fluid. The minimum storage time is six months. On completion of dissection, the remains are buried in a cenotaph, generously provided by the city of Vienna.

As can be seen from these figures, our routine duties have to be quite elaborate to provide an adequate learning experience for such a large student population. Also, the very magnitude of our effort demands considerable expenditure of funds and time. Since much of our instructional material is so short-lived, it would seem that plastination would have been eagerly welcomed when it became available about a decade ago. But, as one might imagine, such a novel and complicated technique did not win easy acceptance, particularly since its establishment required an additional investment of resources (Lischka et al, 1984 ; Lischka et al, 1984)

HISTORY OF PLASTINATION AT THE INSTITUTE OF ANATOMY

We began plastination using nothing more than the equipment available in the workroom of the museum. We had a small vacuum chamber and a pump, formerly used for production of transparent specimens according to Spalteholz. Also on hand were some refrigerators and a dehydration set-up that employed a graded series of ethanol solutions. There was (and still is) one MD-assistant affiliated with the plastination unit, but only for a limited time during a portion of his appointment. In addition, we have one technical staff assistant who attends to such routine duties as dehydration but again, only on a part-time basis.

Essential for starting our plastination efforts was sending our professional assistant to a plastination workshop in Heidelberg. Also extremely helpful was a visit to Vienna by Dr Gunther von Hagens, inventor of the process. It was on this occasion that the term "plastination" was conceived one evening in a Viennese tavern.

Because of the limited dimensions of our first vacuum chamber, we were restricted to small specimens. We still have a number of the products of this chamber, plastinated with polymer formulations no longer in use. Unfortunately some of the best specimens of this period were stolen from a collection exhibited at an anatomical congress.

PRESENT-DAY EFFORTS IN PLASTINATION

From the very beginning it was apparent that we needed a rather strict policy to govern the production and use of plastinated specimens. Not only was such a policy necessary for the most efficient use of our limited resources, moreover it fit well with other administrative procedures at our strongly tradition-minded institution. The major elements of this policy were (and still are) :

1. We will use only a limited number of the wide variety of plastination techniques available. Currently, we work with only S 10 and PEM 27.
2. Plastinated specimens must be complementary to more traditional specimens in their instructional use. Their production and employment will conform to that practiced at other quality medical schools.
3. The cost-effectiveness of plastination must be monitored and compared to that of other means of enhancing our ability to provide teaching specimens, such as enlarging our facilities.

As a result of this policy, we are providing only two categories of specimens, both of which were neglected before the introduction of plastination:

1. Slices of whole body, head, neck and extremities
2. Ligamentous preparations of joints

Production of slices fits very well with recent trends in medical diagnostic imaging, such as computer tomography and nuclear magnetic resonance. Also, it is relatively easy to produce good quality slices without elaborate preparation, whereas colleagues are reluctant to provide intricately dissected topographical specimens of a quality that would warrant plastination.

Specimens of joints with intact ligaments are required in large number for our introductory course which takes place in a room within the museum. Previously, only dried bones could be used because of the inadequacy of air circulation in this area. When compared to the cost of installing ventilating equipment, the use of plastinated specimens has proven impressively cost-effective.

THE S 10 STANDARD TECHNIQUE AS PRACTICED IN OUR LABORATORY

We have adopted the following variation of the S 10 Standard Technique for routine use in our production of silicone-impregnated specimens:

1. Fixation is accomplished in the usual manner using a formalin solution.

2. Dehydration is now done exclusively by freeze substitution.

3. Forced impregnation is performed in a vacuum chamber constructed to fit exactly into an existing deep-freeze cabinet. This chamber measures 1/2 meter in depth and contains approximately 120 liters of polymer reaction mixture, thus allowing impregnation of body slices, but not extremities. The access opening is at the front side, a feature we would not recommend. For the first few days of impregnation, we insert a liquid nitrogen trap between our pump and vacuum chamber.

4. Curing is done by the "fast cure" method, which we find alleviates most of the shrinkage problems associated with slow curing.

5. Unlike other laboratories, we do a lot of surface grinding. We now use an industrial machine which permits wet grinding of silicone and epoxy slices up to 30x70 cm.

Our main difficulties center around the staffing problems that result from temporary workers and lack of skilled technical assistance.

PLANNED MODIFICATIONS OF OUR LABORATORY

Although our present arrangement is safe, our first modification will be to provide explosion-proof equipment for compressed air and lighting. We also will have to provide better ventilation for areas where solvents are handled and stored. An innovation we have in mind is to construct a huge shower compartment in which the wet grinding and cleaning of specimens and equipment can take place.

The staffing problem can only be solved by hiring at least one skilled technician having permanent, full-time affiliation with the plastination unit. Only a totally involved, highly trained person can assure the continued output of quality specimens and the safe handling of solvents and chemicals.

We have attempted to present a brief overview of plastination at Vienna. In summary, our experience has convinced us that plastination is the best means of producing long-lasting specimens of high quality.

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