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### **Contributors**

Terry, Robert J. 1871-1966.  
Royal College of Surgeons of England

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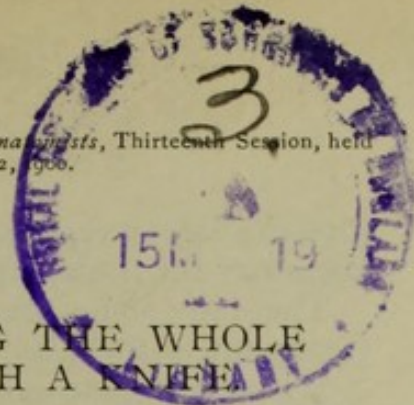
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## A METHOD OF SECTIONING THE WHOLE DECALCIFIED BODY WITH A KNIFE

R. J. TERRY, M. D., ST. LOUIS, MO.

The application of a decalcifying agent to the whole body for the purpose of so softening the bones that sections could be cut with a knife, suggested itself after I had seen some head specimens prepared by my friend Dr. Sluder. He told me that while studying the nasal region he found it necessary to have sections of the head made in some way other than by freezing and sawing, since this method would not give the results he wished; and in trying to devise some more suitable procedure hit upon the decalcifying process. We are all familiar with the fact that decalcifying methods are used in histological laboratories, and it is well known that the same means is resorted to to facilitate the gross dissection of certain parts of the body. Whether any one has decalcified the whole human skeleton *in situ* I am at present unable to say, but all inquiries into the matter have been met with negative answers.

Let me take this opportunity of telling my experience in the work, crude as it now is, with the hope of seeing the process developed into a useful one by the aid of those interested enough to try it.

Briefly outlined: the method consists in a thorough fixing and hardening of the tissues followed by saturation of the body with a diluted acid; after a time the bones are found soft enough to be easily cut with a knife.

For the preparation of small parts, such, for example, as a hand, it is not necessary to inject either the hardening agent or the acid; but injection, coupled with immersion, hastens the process. I have found for this work that formaline by itself or with alcohol is better for hardening the tissues than is alcohol alone, and immersion in a 10 per cent. solution for a period varying with the size of the part is quite satisfactory.

When the piece has been thoroughly hardened it is to be placed in a jar and covered with a mixture of HCl 1 part and H<sub>2</sub>O 10 parts. From time to time the hardness of the bones should be tested with a fine awl, care being taken not to in-



jure the larger vessels. Five or six weeks, or even longer, is necessary for the complete decalcification of a hand.

There are some precautions which must be observed in the treatment of the whole body.

It is necessary to examine the surface carefully for punctures, such as undertakers make with their canulæ in the walls of the belly and chest, or for small gun-shot wounds. If these exist the body is unfit for decalcification.

A bandage should be evenly wrapped about the head, neck, chest and abdomen, in order that the fluids which are to be injected shall be uniformly distributed; for with injections of watery fluids into the vessels there is a tendency to fill the belly and chest to the almost complete exclusion of the limbs. The femoral artery on one side has been selected as the place for injecting the preserving and hardening fluid, which for the whole body has been a mixture of equal parts of formaline and 95 per cent. alcohol. Five or six quarts of this were sent into the artery by an air pressure of 10 pounds.

While the fluid is running into the subject the head and limbs should be put in proper position and means provided to keep them so; the lips and eyelids should have been closed before the bandage was applied.

The subject is to remain undisturbed for two weeks, and at the end of that time the arms and thighs, for convenience, should be amputated a short distance from the trunk, and placed at once in the acid bath.

Turning our attention now to the trunk, the first thing to be done before beginning to decalcify it, is to find and tie all vessels in the stumps, leaving one femoral artery, however, for the insertion of a canula.

The body, still bandaged, should next be placed head downward in some vessel which will not be attacked by the acid. The same proportion of acid to water is used for the trunk as for small parts, but the subject should be injected with it as well as immersed in it. The injection should be done at least twice a day, adding more acid to the fluid as it becomes weaker.

When the mandible and the upper part of the femur can be punctured with a fine awl the body can be sectioned, for, I have found, these are the last parts to yield to the acid.

About ten weeks are required to bring about complete decalcification.



Up to the present time no attempt has been made to embed the trunk in a thorough way ; I expect to undertake this with a subject now decalcifying.

The first body which was sectioned by me was embedded in a stiff glycerine jelly, and while this maintained the trunk in a fairly steady position, yet the jelly was difficult to cut and caused no little trouble on that account. The sensation experienced while carrying the knife through the softened bones is like that of cutting leather. Sometimes a hard spot is encountered, but not often ; it emphasizes the necessity of prolonged soaking in the acid. When freshly cut the sections showed no distortion or unequal shrinkage of organs or body walls ; there was no disintegration of the soft parts and the bones and cartilages alike were unchanged in size and shape.

But after all, it will be asked : "What is gained by this method?" For making thick sections I should prefer to freeze and saw the body ; but for thin sections or for complete serial sectioning of a part of the body, or of the whole body, the saw is not as good as the knife blade. The saw, however fine it may be, wastes something ; there is saw-dust. So I believe that with improvements in the mode of fixing and hardening the tissues, and with a proper means for embedding the subject, this method of section-cutting will be found useful in the reconstruction of regions, particularly for the study of the relations of organs to the body walls. Sections for such a purpose need not be of the thinness demanded for microscopic work ; perhaps a thickness of 2 mm. would be found suitable in the reconstruction of most regions intended for naked-eye study. A few sections not thicker than this have already been cut, without embedding.

