METHODS OF PRESERVATION OF ANATOMICAL MUSEUM SPECIMENS

THESIS

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By

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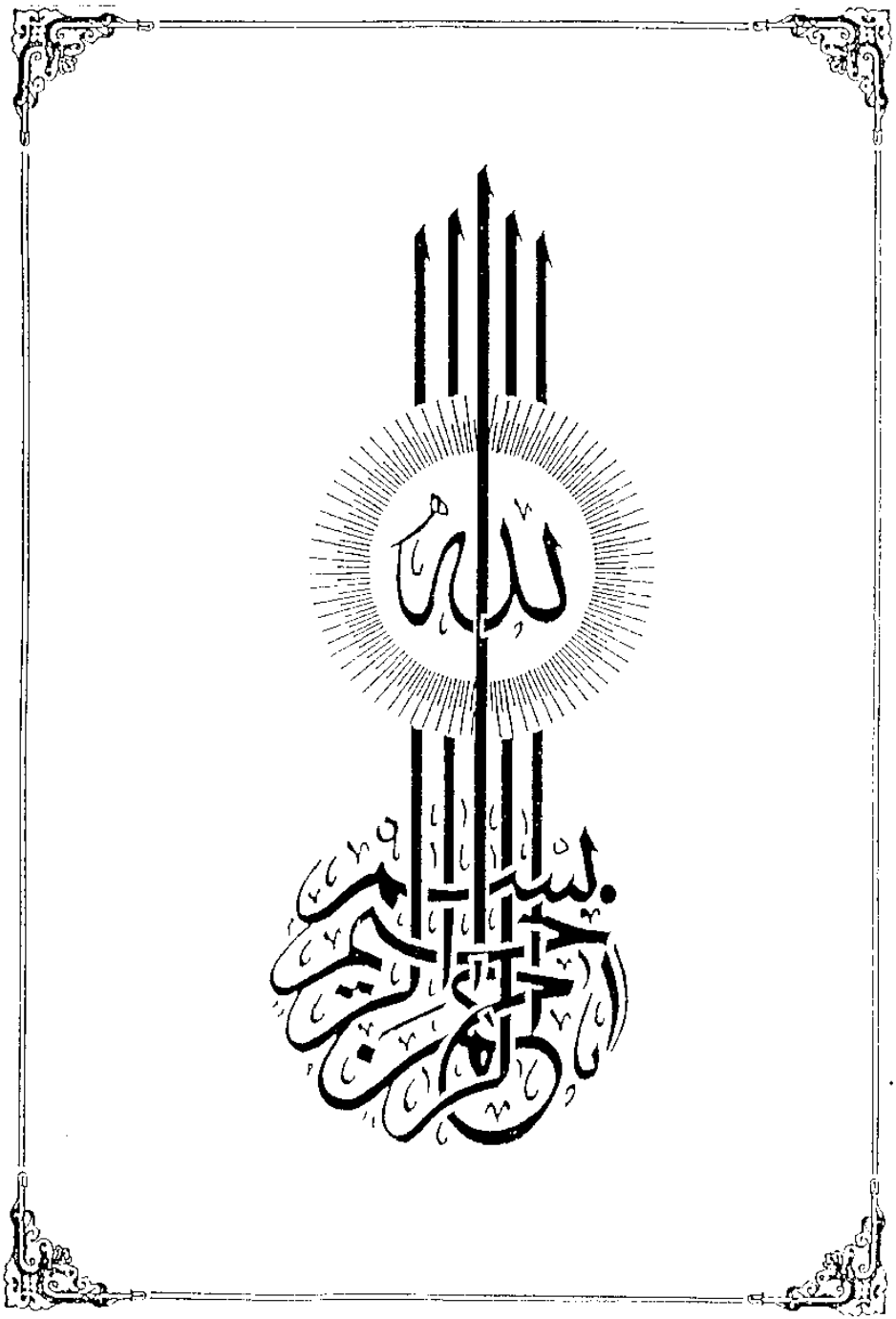

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INTRODUCTION

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The methods of preserving anatomical specimens had attracted the attention of many authors.

Hibben and Knight (1937) Used methyl methacrylate monomer as suitable media for mounting after its polymerization.

Puckett (1940) described the use of ethyl methacrylate as mounting medium for preservation of anatomical specimens.

Sakla (1959) reported the dry method for preservation of anatomical specimens.

Hagens (1979) recorded a new method for impregnation of biological specimens with thermosetting resins.

The anatomical specimens were preserved in museum by promoting them in glass jars filled with a preservative containing formalin, potassium acetate, glycerol and distilled water. The main disadvantage of this method were the change in colour of both the specimen and preservative and , in addition, the difficulty in handling the specimens after mounting.

The aim of the present work was to describe a new method for preservation of anatomical specimens for teaching purposes obviating the use of jars and preservative.

REVIEW OF LITERATURE

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REVIEW OF BODY PRESERVATION BY THE ANCIENT EGYPTIANS

The methods of the preservation and mummification of Ancient Egyptian bodies were studied by Leiden (1955). The only method of preserving the human body known to the Ancient Egyptians, was desiccation. The dehydrating agents used were salt and natron, as quick lime was never used in Egypt before the Ptolematic period. After treating the body with natron, it was so desiccated that no further drying was needed.

During the Old Kingdom (C. 2250 B.C.), an alabaster box divided into four compartments was found in which the viscera of Queen Hetepheres were immersed in 3% natron solution after having been wrapped up in linen bandages. This custom was the first phase of the preservation of the viscera. In order to preserve the features of the dead person and counteracting their distortion by decomposition of the tissues, linen strips soaked in resinous materials were moulded on the shrunken body. Sometimes resins were used in paste form. The abdomen and other body cavities were stuffed with linen. Limbs and external organs were accurately moulded in the resinous linen under thr outer bandages. Signs of careful bandaging were already present in the second

Dynasty mummy. The heart was treated separately, from the VIth Dynasty onwards, it was removed and a stone substitute was placed in the body.

However during the Eleventh Dynasty (2100-2000 B.C.) the abdomen of some mummies were not opened and all the organs were still present. Attempts were made to preserve at least the surface of the bodies, they were bandaged when they were still soft. In general no incision of the body was found.

During the Twelfth Dynasty (2000-1780 B.C.) this treatment was elaborated, the incision in the flank grew more common and the viscera were generally removed. Liver, lung, stomach and intestines were preserved in the four Canopic jars.

During the New Kingdom e.g. practically down to the 21st Dynasty (1546-1055 B.C.) an entirely new state of affairs was found. Solid natron was definitely in common use to stop the decomposition of the body surface. The brain was carefully extracted as were the viscera. The heart was returned to the body after treatment. The abdominal and chest cavities were carefully filled with linen impregnated with resins. Sometimes hot resinous mixtures were poured into them. Some mummies were covered with a layer of bees wax before bandaging.

F- Juniperus phoenicea, juniper was a type of fruits not present. Ancient Egyptians used to put it on the dead bodies.

G- Lichen was found in the abdomen of RAMSIS IV (1167 B.C.).

H- Resin which was not present in Egypt. It was insoluble in water but soluble easily in alcohol and ether.

He also discussed the steps for mummification in Ancient Egyptians, where the cadever was transmitted to the room of mummification to be put on a sliding table after removal of dressings. The brain was extracted via the nose and sometimes via foramen magnum. The abdominal viscera were removed through an abdominal incision, starting by removal of intestine, liver, spleen but the kidneys were left as such. The diaphragm was splitted to remove the lungs, while the heart and its large vessels were left intact. The abdomenal and thoracic cavities were washed by a mixture of spices and wine of date. The viscera were treated with natron, wax, perfumes and resins respectively. The body was washed by dry natron after removal of the viscera, then it was placed on a sliding table with a small channel ended by a reservoir for collection of the water resulting from the process of osmosis. The body was cleaned from natron by washing it with water and it

was dried by multiple layers of dressings. Skull cavity was filled with resins and linen saturated with resins and also the thoracic and abdominal cavities were filled with perfumes, linen, resins, natron and two onions were added. The body was covered by a layer of cedar oil. The mouth was filled with linen soaked with resin and also ears, eyes and nose. The whole body treated with melted resins to make the body more solid and to block the superficial bores for prevention of humid air enterance. The body was covered by coloured material above the resinous layer. It was wrapped up in clothes perfectly and strictly using gum and resin. He added that the main idea of mummification was desiccation of bodies to prevent the growth of anaerobic organisms on the tissue.

Two main chemical reactions were occurring during mummification i.e. desiccation and saponification. Desiccation where water was removed from the body via osmosis, while saponification was formation of soap as a result of reaction between natron and body fat leading to separation of glycerol from the fat.

DEHYDRATING MEASURES

Reviewing the literature, it was found that Painter (1924) used aniline oil as dehydrating agent instead of higher concentrations of ethyl alcohol.

Zirkle (1930) stated that the common procedure in dehydrating, clearing and embedding was to replace the water present in the specimen with ethyl alcohol.

Heinz and Arnold (1931) used dioxan as substitute for both alcohol and clearing reagents. This was confirmed by Weissberger, Young and Carleton (1934) who fixed the heads of larval lampreys and gonads of lampreys in pure dioxan containing few granules of anhydrous calcium chloride. They noticed that the shrinkage was not excessive. They mentioned that dioxan reduced the number of operations necessary for embedding. They added that dioxan vapour was toxic when it was inhaled for a long period and vessels containing it should be well stoppered.

Johansen (1935) found that both tertiary butyl alcohol and dioxan produced no hardening of tissues and gave perfect preservation.

Mettler and Mettler (1936) used a simple method for the production of undistorted durable anatomical specimens. The specimens were fixed in formalin, washed

in water and then dehydrated by 95% alcohol. The specimens were transferred to benzyl alcohol until saturated then were placed in saturated solution of Bakelite resin XR6787 dissolved in 50% benzyl alcohol and 50% glycerine at 65°C. They were placed in incubator at 50°C to 60°C until solution changed to mushy white mass of consistancy, then the specimens were removed from, rinsed off with hot water meanwhile brushing excess solid off with a moderately stiff brush. The specimens could be handled with ease and were not affected by dampness or heat.

Inkster (1937) used cellosolve in place of alcohol for embedding small pieces of tissues because of its rapid dehydrating effect.

Garven (1938) recorded that dioxan did not cause undue shrinkage and hardening of the tissue. He mentioned that both dioxan and ethylene glycol were toxic.

Ward (1940) used dioxan as a dehydrating agent and found that specimens fixed in the warm dioxan were completely dehydrated, while those in the cold and alcohol series were not.

Hall (1943) reported a method for dehydrating dioxane. He described the freezing of the hydrated dioxane in a refrigerator at from 2 to 5°C and thus the water content was lost leaving crystalline dioxane

which after melting was recovered as actively dehydrating substance.

Frontera (1959) using different fixatives, reported the changes observed in Macaque brains dehydrated by several dehydrating agents. He found that Ciaccio's as a fixative produced the least shrinkage, 10% formalin and the acacia mixture caused the same percent of shrinkage, while buffered orth's fluid caused the largest amount of shrinkage. Cellosolve as dehydrating agent caused the least amount of shrinkage followed by tertiary butyl alcohol, dioxan and tertiary butyl alcohol & amyl acetate. While either ethyl alcohol and ether or ethyl alcohol and amyl acetate produced the largest amount of shrinkage.

KAMAL [redacted] (1959) described a method for preserving anatomical specimens. They were kept in dry state and retained their normal shape, where muscles, nerves and blood vessels could be easily handled by the student. The specimens were fixed in 10% formalin and drained from excess formalin by squeezing gently and left for next day covered with gauze. They were painted by means of a camel hair brush daily for fortnight with the following mixture, 50% glycerine, 96% alcohol, 25% acetone. They were left covered with gauze exposed to air for a week to drain the excess. The vessels and

nerves were coloured and left to dry. The specimens were painted several times with pure acetone, then 3% celloidin solution. Celloidin painting was repeated and specimens were left to dry. Sometimes if the celloidin solution was excessive a whitish film appeared on the specimens which was removed by a piece of cotton soaked with acetone. The specimens prepared by this method were kept in dry state exposed to air. They became brownish in color and their sizes decreased slightly as a result of dehydration.

Loreti (1972) described a dry method for preservation, where the anatomical specimens were fixed in 20% formalin for 20 days, then the specimens were soaked in mixture 1 formed of 100 cc of 20% formaldehyde, 50 cc of 5% mercuric chloride and 25 cc of commercial glycerol, then soaked in mixture 2 formed of 100 cc of 10% phenol, 100 cc of commercial glycerol and 50 cc of 10% zinc chloride. The specimens were painted with equal parts of linseed oil and olive oil or walnut which was repeated until no further absorption took place. Olive oil or walnut oil was used for the final coatings, which gave softness to the specimens, the outer oily coat was renewed from time to time. The length of time during which the specimens were soaked in mixture 1 depended upon the size and type of material used. Hard tissues