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# Creating of 3D anatomical phantoms with En and Pn plastinated slices

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This visual educational method is being developed in a three-year project of Thracian University dating back to 2012 year. After the approval of S10 plastic technique in teaching morphology E12, R35 and R40 were introduced as new techniques for making plates of brain and slices of the body and limbs. In these techniques by means of Biodur through participation of ultraviolet light are made thin (up to 10 mm) transparent plates of natural biological material. The plates preserve the natural ratio of the organs placed at the appropriate topographic level.

Three-dimensional anatomical forms can be made from all parts of the body – head, neck, legs, chest, abdomen and pelvis. Ranking them in the order in which they are separated from the human or animal body restores bodily structure but with perennial topographic products. A circuit on which is marked skeletotopiya slice constituting the human body can be added to the anatomical phantom.

*Keywords*: Biodur, plastination, P40, impregnation, brain slices.

## Introduction

After approval of S10 plastination technique in teaching morphology introduced the new E12, R35 and R40 plastination techniques for making plates of brain [3, 13, 15] and slices of whole body, brain or limbs [6, 8]. They using Biodur, featuring ultraviolet light, natural biological material is produced thin (10 mm) transparent plates that retain the natural ratio of organs located at the appropriate topographic level [5, 14].

This is a three-years project from 2012 of the University of Thrace for an educational method development – 5132 levs value [16].

## Purpose

The purpose of this presentation is to introduce the scientific society with the possibilities of En and Pn plastination techniques.

## Material and Methods

We use organic material that is available in the Laboratory of plastination. The material freezes at -25°C and it cuts with a band saw plates with thickness up to 10 mm. The size of the cuts made in compliance with the size of impregnation cameras we have.

En plastination techniques are rarely used because the epoxy techniques are more suitable for research in histology, although it is possible their use for making cuts from the whole body, limbs or parts thereof. Dehydration performs step-wise with acetone at room temperature. Impregnation is carried out with a mixture of Biodur E12 and Biodur E1 in the ratio 4:1. Forced impregnation achieves gradually to vacuum 5 mm Hg. Gas-curing occurs within 24 hours at room temperature.

Pn plastination techniques, especially R40 technology is applied more often, but predominantly in brain slices due to the high quality of the products. Fixation, dehydration and impregnation are standard, but drying is carried out with the participation of ultraviolet light. Glass casting chamber is filled with P35 or P40 resin and biological material was put into the chamber. It was exposed to UV light sources until cured.

## Results

**Fig. 1.** The P40 polymer in chambers formed a solid gel by 30 minutes of exposure with UV light and cured completely 40 minutes later. The plates, made with En plastination technologies are translucent, but they are distinguished by high strength. Pn cuts are primarily used for studying the brain. They are highly transparent polymer plate. Both En and Pn have pronounced details and preserve the natural ratio of the organs placed at the appropriate topographic level.

**Fig. 2.** A circuit on which is marked skeletotopiya slice constituting the human body can be added to the anatomical phantom.

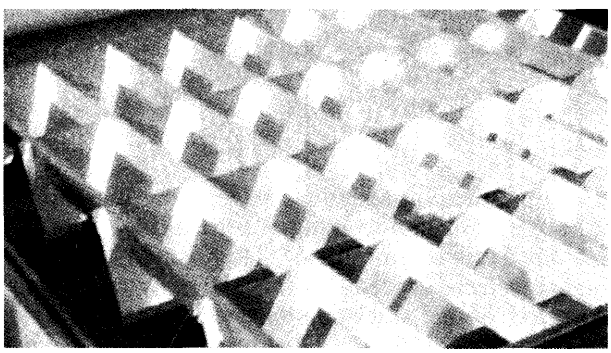

Fig. 1. UV chamber for P40 plastination technique.

| Legend: Abdomen preparations | | |
|---|---|---|
| **Slice number** | **Sceletotopy** | **Objects** |
| **P7** | **9-th right rib cartilage** | **Liver, Diaphragm, Stomach** |
| **P8** | **11-th right rib cartilage** | **Gall-bladder, Transv. colon** |
| **P9** | **1-st lumbal vertebra** | **Pylorus, Spleen** |
| **P10** | **2-nd lumbal vertebra** | **Duodenum** |

Fig 2. A sample legend to slices of the human body.

## Discussion

Although the study of individual cuts shows topographic relations of a certain level, it dose not give accurate perceptions about the overall structure of the human body. This can be achieved by building a three-dimensional anatomical forms. This is according to publications of other authors [1].

They can be made (via E12 plastination technique) ) [2, 7, 10] from all parts of the body – head, neck, legs, chest, abdomen and pelvis [2, 11, 12].. Ranking them in the order in which they are separated from the human or animal body [4] restores bodily structure but with perennial topographic products [1, 6]. Some investigators use 3D plastination atlas for parallel study to MRI [4].

A corpse which is fully build can be placed in a natural vertical construction or lying down, and limbs – in special racks. Brain plates [9, 13, 15] may be arranged in the skull in their natural state.

## Conclusions

1. 3D models are a better idea of anatomical detail, demonstrated with preparations compared with two-dimensional models.

2. They are made easily and are an excellent resource for studying the human body.

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