

## A NEW METHOD FOR PRESERVATION OF LUNGS

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### INTRODUCTION

Commonly used methods for lungs preservation require lungs in the fresh (not fixed), or formalin-fixed state to be dried by forced air. These methods produce specimens in their anatomical configuration, but the dried lungs maintain a fixed, non collapsible shape, are bleached and have a texture of Styrofoam, which breaks off easily.

In 1990 Henry and Butler described a method for "forced air" impregnation of dried (not fixed) lungs with polymer BIODUR S10/S3 and xylene mixture. This method, which is a modified plastination process (von Hagens, 1987), produces white, more durable and flexible lungs compared with dried specimens. It takes, however, between 4 and 10 days for impregnation of one set of lungs and requires frequent monitoring.

This paper introduces a new method of fixation of lungs, which provides flexible, more durable, better textured specimens. The lungs can be dyed pink to make them look more realistic.

### MATERIALS AND METHODS

Fresh, intact canine lungs and heart were removed at autopsy, transported into the plastination laboratory and placed into a suitable container for flushing out with cold tap water. The fascia and fat from vessels connecting the specimens were carefully dissected off, so vessels from both organs were tied off, enabling a separate

processing of the heart. Ligation of vessels at this stage was beneficial in respect of the amount of chemicals used and the success of inflating the lungs during processing.

Tygon tubing of appropriate diameter (Fisher Scientific, Whitby, Ontario, Canada) was inserted into the trachea and securely tied in place. The lungs were carefully filled to near capacity with a 0.1% solution of heparin (heparin sodium USP, A&H, Glaxo Canada Ltd, Toronto, Canada) in cold tap water and left in the container for 30 minutes in order to remove any remaining blood. The lungs were emptied and re-filled with cold tap water several times, until the water flowing out of the lungs was clear.

To remove the soluble proteins and fats from the lungs, the specimen was transferred into a 1 % solution of non-ionic dish washing detergent (any commercially available, for instance "Joy" or "Palmolive") in warm water. The lungs were filled up with this soapy liquid and left to soak for 30 minutes. The lungs were then rinsed several times in cold running water. When the rinsing was complete, the lungs were fixed. They were filled with and submerged in a solution of Klotz fixative (von Hagens, 1985), covered with a towel to keep submerged and left to soak for 24 hours.

After fixation the lungs were not washed. Excess fixative was allowed to drain out of the tissue and the lungs were dyed and oiled using a saline solution (30g NaCl technical or household grade in 1 liter

of warm water) with 10g/liter Lipoderm Liquor' (LL, BASF Canada, Rexdale, Ontario, Canada) and 2g/liter Eosin powder (Fisher Scientific, Whitby, Ontario, Canada: histological stain). The lungs were filled quickly with the finishing solution, immersed in a bath of the solution, covered with a solution-saturated towel and left to soak. The specimen turned pink and after 45 minutes, 0.3% ammonia (Fisher Scientific, Whitby, Ontario, Canada) was added to adjust the pH to 8.5-9.0 and force optimal amount of stain and oil into the lungs. The lungs were periodically turned over, covered with a towel and left in the bath over night. The following morning, the lungs were removed from the oil-dye bath, drained and suspended on a cheese cloth sling in a fume hood. Compressed air was then blown through tygon tubing inserted in the trachea. Flow of air was adjusted so that the lungs expanded to near normal holding capacity. While drying, the trachea was brushed 3-4 times with the oil and water (50:50) mixture to ensure its flexibility. The average size canine lungs require 1-2 days to dry completely. When dry, the lungs were sprayed with a silicone-based water repellent ("Scotchguard"), commonly used for water proofing of leather in order to protect the finished lungs from dirt, dust and water. When the drying was complete, the entire area of the lungs and trachea were softened by gentle squeezing with finger tips (small areas at a time).

Lipoderm Liquor is an emulsified synthetic oil used in the tanning industry for finishing soft leather. Instead of Lipoderm, 1-2 egg yolks (which contain natural emulsifiers and oils) per liter can be used.

## RESULTS AND CONCLUSIONS

The method described produced soft, flexible, spongy and inflatable pink lungs, which have a "fresh" appearance. The lungs, trachea and bronchi are flexible and anatomical relationships are maintained. The specimens are durable and can be protected from staining and dirt by "Scotchguard" treatment. The lungs are collapsible (Figure 1a) and can be readily inflated (Figure 1b). There are important improvements in this processing technique when compared with the plastination process (von Hagens, 1985; Henry and Butler, 1990). These include: the elimination of the use of solvents (acetone, methylene chloride and xylene) and processing time is considerably shorter (3-5 days).

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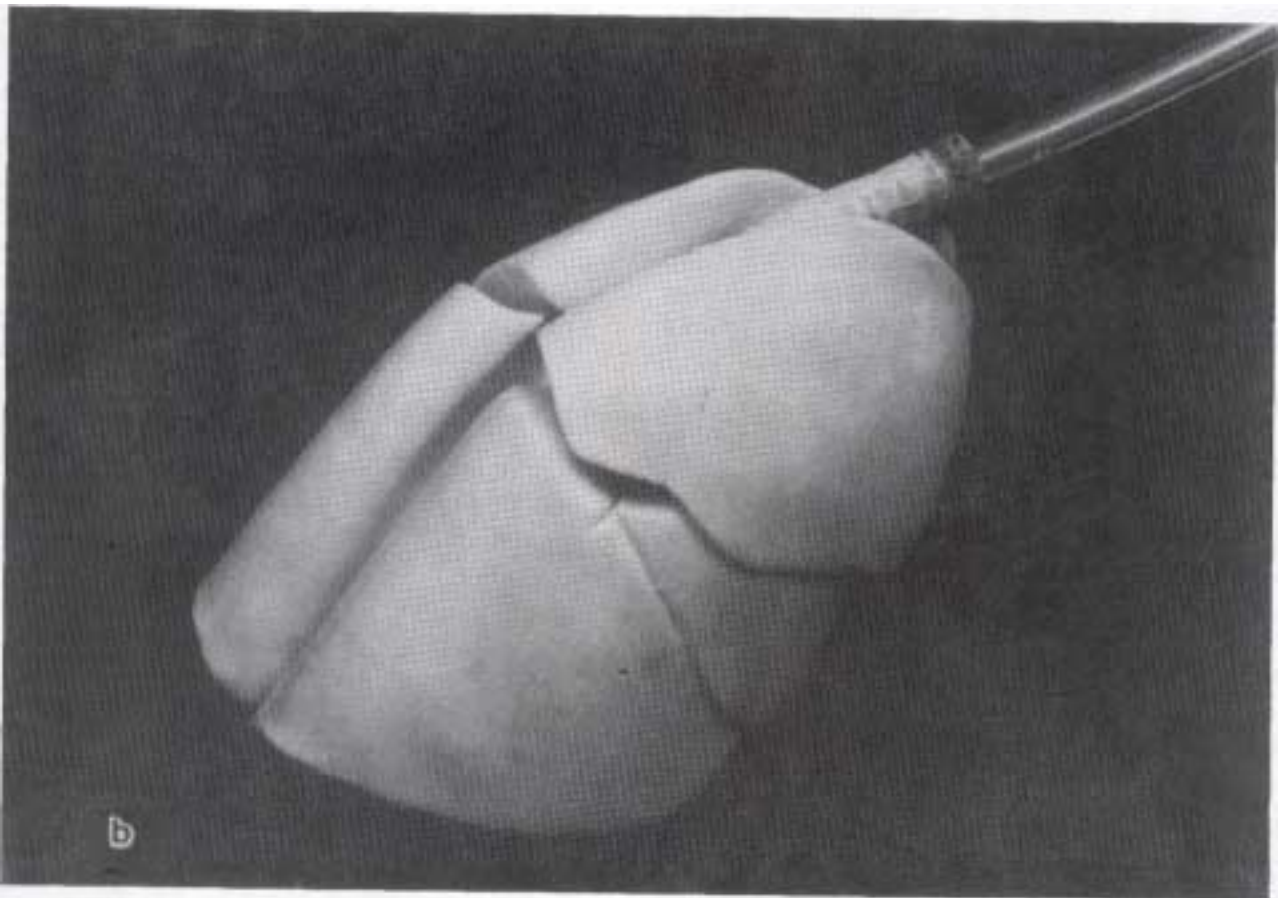
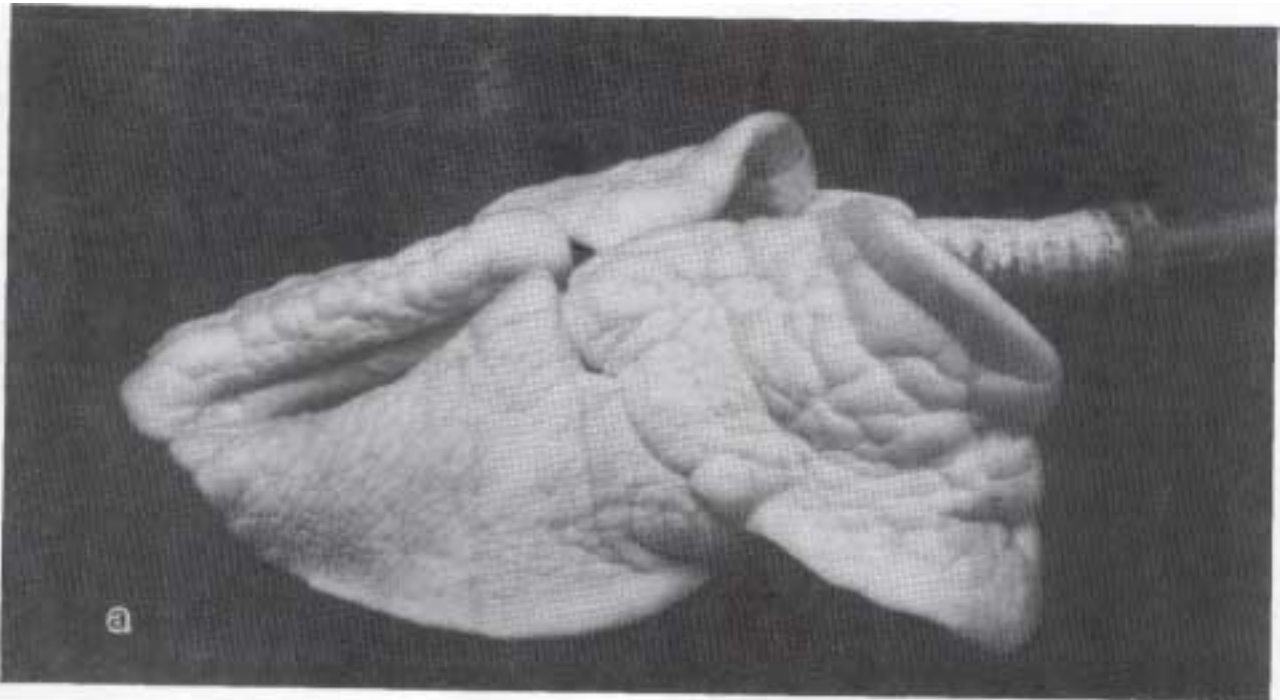


Figure 1. An example of dog lungs preserved with the new technique. The lungs are sufficiently flexible that they can be collapsed (a) and inflated (b).