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# “Effectiveness, Adaptation, and Health Risks of Embalming Fluids: Just What is the Solution?”

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# Who am I?

- Started my career at the Dept of Vet Anatomy in 2001 as a junior technician
- Currently manage the medical and veterinary dissection suites at the University of Bristol in the UK

# Who am I?

The Institute of Anatomical Sciences

- Joined the Institute of Anatomical Sciences (IAS) in 2001 and became ‘Secretary’


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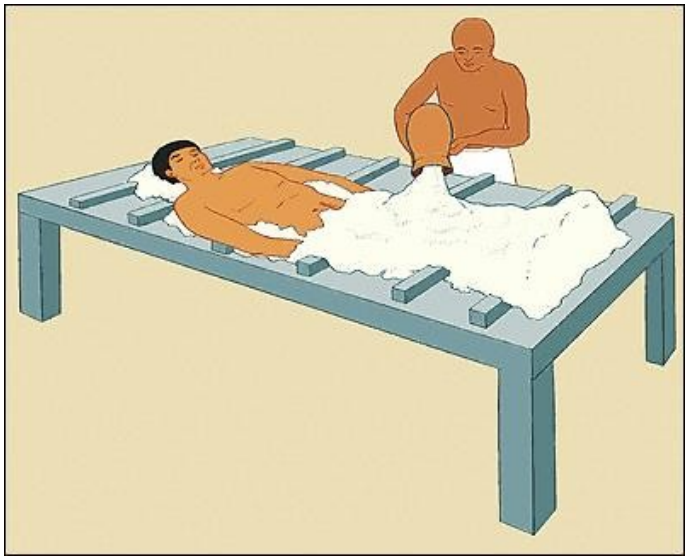
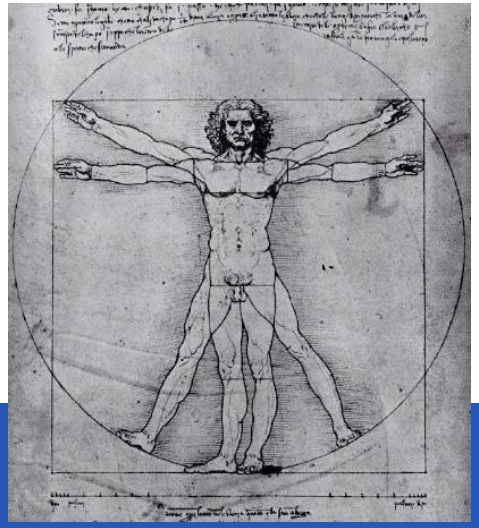
# Brief history of preservation techniques through the ages

- Ancient Egypt 3000BC
- Mummification



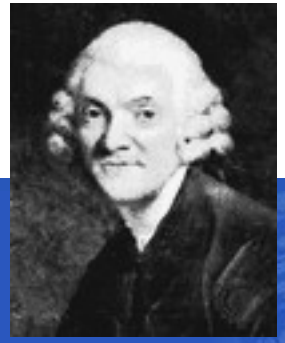
# Brief history of preservation techniques through the ages

- Renaissance anatomists- Da Vinci et al
  - Leonardo da Vinci (1452 - 1519), was probably the first to inject chemicals/wax into the specimens that he dissected and drew.



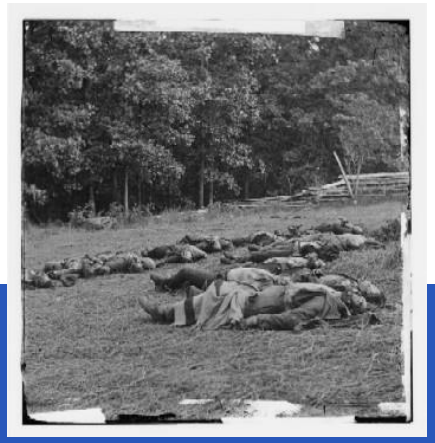
# Brief history of preservation techniques through the ages

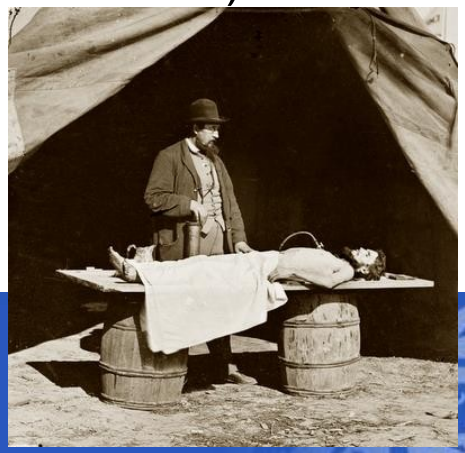
- William Harvey(1578 –1657) – *Harvey was an English physician who was the first to describe accurately how blood was pumped around the body by the heart.*
- Dr. Frederick Ruysch (1665-1717)- *Danish physician pioneered arterial embalming*
- William Hunter(1718–83) - *The Scottish anatomist, however, is credited with being the first to report fully on arterial and cavity embalming as a way to preserve bodies for burial.*



# Brief history of preservation techniques through the ages

- Dr Thomas Holmes(1817-1899) - Generally considered the father of modern embalming.
  - He experimented with preservative chemicals: arsenic, creosote, mercury, turpentine and various forms of alcohol,
  - He reportedly embalmed over 4000 soldiers and officers from the union army during the American Civil War (1861-1865)

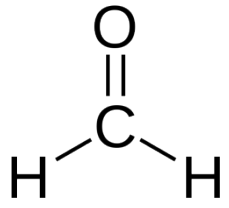


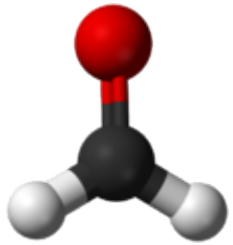


# Brief history of preservation techniques through the ages

- Discovery of Formaldehyde and its effects.
  - August Wilhelm von Hofmann - In 1867, the science of embalming took a step forward when the preservative chemical formaldehyde was discovered.
  - more effective - and more economical - preservative than previous solutions of oils of turpentine, lavender, rosemary or vermillion which had previously been recommended by William Hunter.

# Efficacy of Formaldehyde as a preservative?



- Chemical formula – CH2O
- Formalin?
- Action- how does it work?
- What other chemicals combine with Formalin to produce best preservation?

# How Embalming Fluids have changed to meet the requirements of the profession?

- Introduction of different chemicals to give different effects – fixation or flexibility?
  - Soft embalming techniques – Cambridge(cantabrian solution)
  - Theil
  - Use of Fresh/Frozen cadavers in post graduate surgical training courses

# Cambridge(cantabrian solution)

- First developed in 1985 by Bari Logan – Reduction in Formalin from 10% to 3% replaced with Methanol.

| | g/Kg | ml/L |
|---|---|---|
| 0315 ETHANOL INDUSTRIAL (99% IMS) (74 OP) | 394.650 g | 500.000 ml |
| 0332 FORMALDEHYDE SOLUTION 40% w/v pure | 86.347 g | 79.000 ml |
| 2199 POLYETHYLENEGLYCOL 200 | 84.000 g | 75.000 ml |
| 3360 CITRICIDAL | 11.100 g | 10.000 ml |
| 0757 WATER DEIONIZED | | 336.000 ml |

- Results - greater flexibility, good fixation, less harmful fumes
- Still being used today

# Theil Solution

Developed in 1992 – Prof W. Thiel, Institute of Anatomy, Karl Franzens University, Graz, Austria.

| | Arterial infusion | Venous infusion | Tank fluid | Moistening fluid |
|---|---|---|---|---|
| Hot tap water | 6.8 ltr | 1.45 ltr | 1250 ltr | 20 ltr |
| Boric Acid | 250 gr | 80 gr | 45 kg | 600 gr |
| Ammonium Nitrate | 1680 gr | 520 gr | 150 kg | - |
| Postassium Nitrate | 420 gr | 130 gr | 75 kg | - |
| Sodium Sulphite | 700 gr | 190 gr | 105 kg | 1 kg |
| Propylene Glycol | 2.5 ltr | 780 ml | 150 ltr | 1 ltr |
| Stock II | 500 ml | 190 ml | 30 ltr | 200 ml |
| Formalin (8.9 %) | 2.1 ltr | 1.5 ltr | 125 ltr | - |
| Morpholine | 150 ml | 110 ml | - | - |
| Alcohol | 1 ltr | 1.1 ltr | - | - |
| Total volume [ltr] ca. | 12.5 | 5 | 1720 | 22 |

- low-odour embalming technique
- colour, consistency and transparency of the tissue were very well preserved
- Superb flexibility – comparable with fresh tissue
- Expensive??

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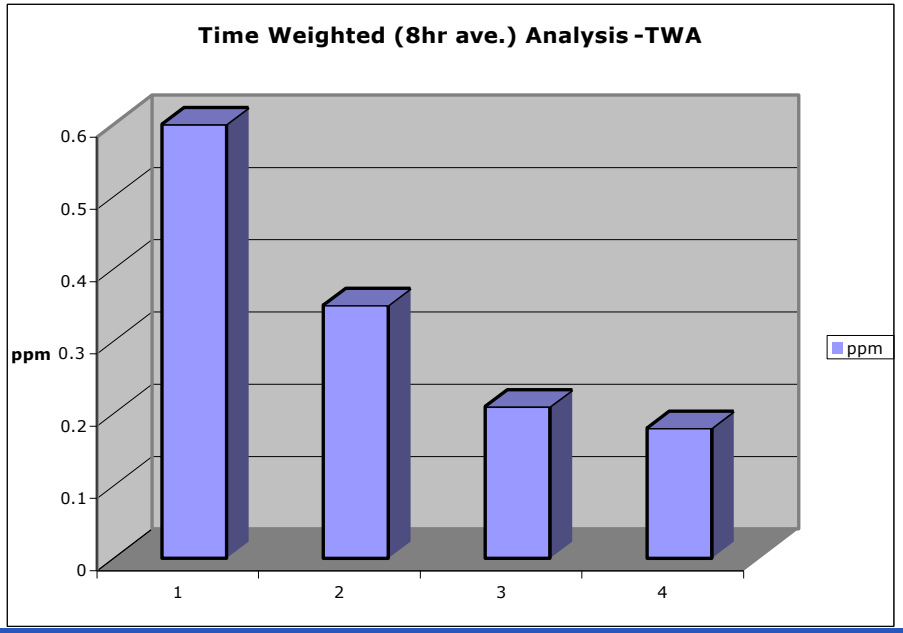
## Health risks associated with Formaldehyde and Embalming fluids in general – What can be done to address these risks – what does the law allow?

- Law as it stands in EU, UK and USA
- Classification of Formaldehyde
- Proposed changes to classification – HSE, SCOEL IOEL Directives
- Views from the UK Anatomy Sector – PGaPAC response to the HSE

# What alternatives to Formaldehyde 'heavy' embalming solutions are out there?

- Formalin neutralisation
  - Infutrace, Perfect Solution
  - Michigan state University, Medical School using Monoethanolamine

1= Before engineering controls
2= After engineering controls
3= After Infutrace
4= After MEA



# Conclusions – if any?
# Embalming Fluids- just what is the solution?

- So are there any alternative fixatives as effective as  Formaldehyde?
- Can we adapt embalming fluids further or have we gone as far as we can?
- Are the solutions we are using as safe as they can be?

# Contacts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# THANK YOU