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Title: Problems with Lipid and Fluid-preserved Specimens

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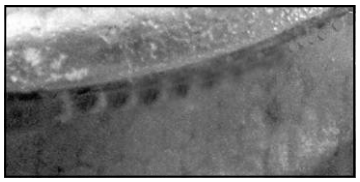
Problems with lipid and fluid-preserved specimens

- Simon Moore, Natural Sciences Conservator

Abstract
Are the fluids preserving your natural history specimens looking rather yellow? Does your Damien Hirst shark or lamb look a bit 'off colour'? The problem with fluid-preserving zoological specimens, particularly vertebrates, is that they still contain lipid which cannot be fixed. This paper outlines this problem and suggests preventive measures.

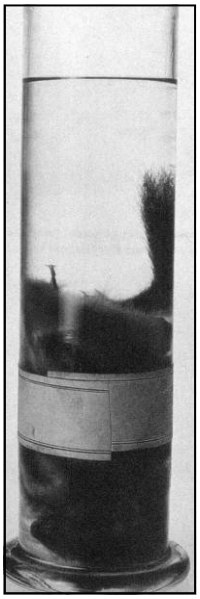
Lipids are well-known to us as the building blocks of all that unwanted subcutaneous fat which can disfigure our bodies. What we may not realise is that lipid is essential in our bodies for maintaining a healthy metabolic balance. The same applies to all other animals especially such vertebrates as marine mammals and fish, even more, elasmobranch fish such as sharks and rays who store large amounts of lipids in their livers.

The problems usually arise from ignorance - many assume that formalin is a universal fixative. Carter (2001) has outlined how formaldehyde cross-links with the amine and amide side-groups of proteins, causing cross-linkage that renders them more 'stable' and resistant to bacterial breakdown. Although fat-containing cells or lipocytes are actually fixed by formaldehyde, their contents (lipids) are not. The lipid gradually osmoses through the lipocyte membrane and pervades the formaldehyde solution turning it a pale yellow (initially).



Globules of lipid in formalin extruded subcutaneously from a preserved snake specimen

Since the lipid is less dense than the preserving fluid, it floats to the top forming small globules. In contact with air the lipids gradually oxidise and take on a deeper colour, darkening the fluid to orange. As more lipids escape from their lipocytes, the floating globules coalesce into greasy floating masses. As these continue to oxidise, they release fatty acids into the preservative, lowering the pH. When the pH drops to below 5.5, the process becomes accelerated, also bringing about skeletal decalcification and tissue denaturation.



Stoat preserved in alcohol that was formerly severely contaminated with lipid which subsequently oxidised and decalcified the stoat's skeleton. The stoat now stays in this 'concertina' position!

Collection managers frequently come to me asking why in c. 1977 were they asked to reduce their levels of formaldehyde in collections by converting to post-fixation preservatives such as Steedman PFP, (more recently) Opresol or one of the other phenoxetol/ 2-phenoxyethanol-based preservatives. I have already written about slow penetration of aqueous fixing/preserving solutions and how that densely-muscled fish will gradually decay in these solutions, which were originally designed for fixing and preserving zooplankton (Steedman, 1976) – a rather different kettle of fish if you'll excuse the pun (Moore, 1997, 2001b).

Many collections are now reverting to alcohol as a preservative but having to take on board the problems of fire risk and evaporation, leading to fungal infestation (Moore, 2005), this is creating a different rod-for-back situation. Although alcohol will dissolve lipid it can still become saturated, leading to serious contamination problems associated with lowering of pH and tissue breakdown.

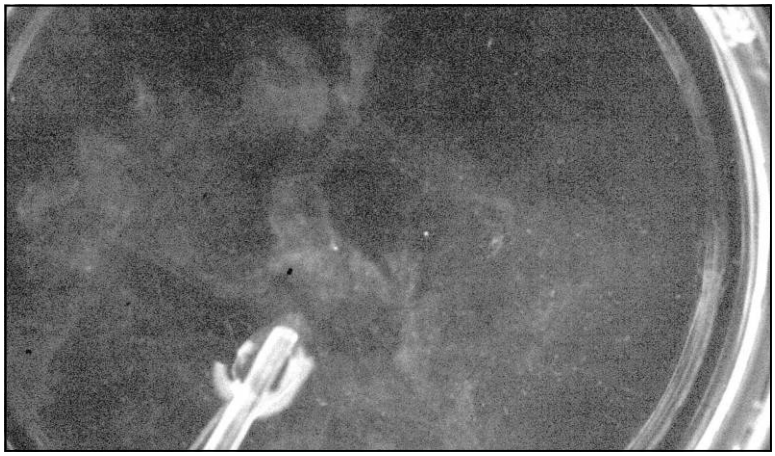
Preventive measures

Lipid-bearing organs such as fish liver, should either be removed or the specimens should be prepared over a longer-term allowing the lipid to escape and be removed until it no longer is a problem but this can take several years. Transferring to alcohol to dissolve out lipids can accelerate the process but the specimens must be carefully transferred to alcohol (Moore 2001a) and then transferred back to formalin or a suitable preservative. This especially applies to display specimens and works of art or else an annual check and replacement of preserving fluid must be carried out.

Test

Preservative solutions can be tested for lipid content by pipetting a small amount into a Petri dish of water on a black background: the turbidity level caused by the dissolved lipid can be seen as a white cloud around the pipette.

Lipid-saturated IMS squirted into a Petri dish of water showing the resulting white emulsion clouds of lipid contamination



Conclusion

As usual the main problem for lipid contamination is down to ignorance or short-cutting. I can only hope that specimen preparators will bear this in mind, whether the specimens are destined for museum collections and displays or sold as works of organic art. They have to be properly treated during the preparation stage and again at the moment when escaping lipids are saturating the preservative fluid.
If your specimens are deteriorating by this or any other means, they can be saved, staff can also be trained. Contact the website below for help and advice.

www.natural-history-conservation.com

References

Carter, J. Fixation an overview. *Natural Sciences Conservation Group Newsletter,* **18**: 27-232. 2001.
Moore, S.J. Phenoxetol, Friend or Foe? *Natural Sciences Conservation Group Newsletter,* **6**: 44-45. 1997.
Moore, S.J. Transferring specimens from formalin to alcohol. *Natural Sciences Conservation Group Newsletter,* **17**: 43 -45. 2001 (a).
Moore, S.J. Histological effects of fixation. Are preservatives beneficial or not? *Natural Sciences Conservation Group Newsletter,* **18**: 24-26. 2001 (b).
Steedman, H.F. *Zooplankton fixation and preservation.* UNESCO Press, Paris, 1976.