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Phenoxetol, friend or foe? (A personal history)

Those who are old enough to recall phenoxetol coming into use as an experimental preservative in museum collections during the late 60s will recall a sense of relief not having to put up with the smell of formalin or the flammability of alcohol but tinged with a sense of doubt about the longevity and effect of this preservative panacea. It also had its down side - diluting with water (to 1%) produced a white colloid that was no good to man nor beast, leading to many calls asking why and how. Dilution with hot water was the answer and produced a faintly sweet smelling fluid that seemed to work for well-fixed tissue and was so non-hazardous you could have drunk it!

In 1976, Steedman wrote in the UNESCO publication (*Monograph on oceanographic methodology 4*) about fixing and preserving zooplankton using phenoxetol combined with propylene glycol (PG). The PG acted as an additional humectant, should preserved tissues dry out through custodial neglect or accident; it additionally provided solvency for the phenoxetol so that hot water was no longer necessary provided that the two were mixed as a concentrate beforehand. The fixative appeared to be highly effective histologically. Tissue cells were not distorted, shrivelled or exploded by either the fixative or the preservative, staining reactions for Haematoxylin-Eosin, triple stains or histochemical reactions such as Feulgen were all perfect: even after 1-2 years in the preservative the tissue was still looking good histologically - the preservative was working and Steedman seemed to have discovered the fluid preservationist's panacea. Many collections were hastily transferred to the preservative without much thought as to how they had been fixed and we all waited with bated breath to see what the ultimate test of time would bring about.

For my part, I relaxed some fresh-water snails and fixed and preserved them according to the Steedman formulae and for about a year they looked really good. Then I noticed that the tissues, which had slightly swelled in the preservative, were becoming just slightly too swollen and relaxed and could collapse or break up if not supported by fluid. The specimens were transferred back to the formalin-containing fixative to 'tighten them up' for about 3 weeks. After that, the tissues were fine in the preservative. In the meantime, curators known to have made the transfer were notified to check their collections. Some specimens were found to have partly dissociated (due to their dubious fixation history) and Steedman's preservative was given the thumbs down by many curators, rather unfairly I felt since it had been developed for marine zooplankton and many curators were totally ignorant about fixation procedure, even what was a fixative!

Slightly later, Oliver Crimmen (1989) wrote in the BCG Newsletter about the downside of phenoxetol as a preservative and although his fish specimens had been well-fixed and he knew about fixation procedure, something else had gone wrong. It was found that large and/or densely-muscled fish were the main problem and that the phenoxetol was only able to provide a surface preservative for animals with dense tissues; muscle, especially, formed too dense a barrier for the preservative to have any effect - the fish had effectively rotted, over the years, from the inside outwards.

In the late 80s came the discovery that formalin masked DNA and that alcohol was the ideal fixative/preservative (cf. Criscuolo, 1994). Fluid preservation has come full circle and we are now using updated techniques discovered in the late 17th century to preserve tissues.

For my own part, I still find that the Steedman formula works well for smaller invertebrates, small fish and other small vertebrates. Curators and collection managers must weigh up the pros (much less hazardous than formalin or alcohol, less likely to evaporate and require topping up, if specimens dry out they are easier to rehydrate) against the cons (specimens require more regular monitoring, lipid leaching still a problem - as with formalin and alcohol, dubious effect on DNA, unsuitable for large or densely-muscled animals). The trend towards using alcohol as a preservative (and fixative for DNA study specimens) appears to be fine at the moment, museums world-wide have their own preservative formulae, some using isopropanol or mixes. I am still giving phenoxetol a chance and finding that it works well.

References:

Crimmen, O (1989) Phenoxetol: an unsatisfactory preservative for fishes. *Biology Curators' Group Newsletter* 5 (3), 26-27.

Criscuolo, J (1994) Museum spirit collections and the preservation of DNA. *Conservation News* 54, 39-40.

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