This Week's Citation Classic®

Mollenhauer H H. Plastic embedding mixtures for use in electron microscopy. *Stain Technol.* 39:111-4, 1964.
[Electron Microscope Laboratory, University of Texas, Austin, TX]

This paper describes an epoxy embedding resin for electron microscopy that provides good tissue preservation and is easy to section with both glass and diamond knives. [The *SCI*® indicates that this paper has been cited in over 1,875 publications.]

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In 1964 I was at the University of Texas in Austin working in the Cell Research Institute on characterization of plant Golgi apparatus, using mostly maize root tips as the model system. Although this tissue was excellent from the standpoint of ultrastructural topography and consistency, it was not always easy to embed or section for electron microscopy. As in many plant systems, the primary problems were poor penetration of resin and lack of resin binding to the cell walls that often resulted in separation of tissue from resin during sectioning. In this particular instance, these factors were exaggerated since this was a highly student-oriented laboratory where most of the students worked with plants, algae, or fungi and faced the difficult prospect of sectioning with glass knives.

Araldite epoxy resins were introduced into the laboratory shortly after the report of A.M. Glauert and coworkers.[1] Similarly, Epon resins were used and evaluated shortly after their introduction by J.H. Luft.[2] Epon resins had some advantages over Araldite, most notably lower viscosity and simple formulation changes that allowed adjustment of block hardness. However, Epon resins were not as easy to section with glass knives as were Araldite resins, and they had a considerable tendency to chatter and form rippled sections.

The Epon-Araldite mixture that is the subject of this reminiscence was the result of a very simple question: If two resins are mixed together will the resulting resin block exhibit some characteristics from both components and will these characteristics be the ones that will most benefit the problem? A scientific basis for resin formulation and cleavage of sections was not available at that time nor, in fact, is it available today, although much progress has been made and some commitment to improve embedding resins is now visible. In any event, the Epon-Araldite resin mixture proved useful and became the standard for the laboratory for many years. The mixture was easier to section than either Epon or Araldite alone, especially with glass knives, yet provided good tissue preservation and minimal separation of resin from tissue. Its stability in the electron beam was not as great as had been hoped but was no worse than that of Araldite. However, the deciding factor was ease of sectioning. Except for the use of lecithin-doped Spurr resin,[3] the Epon-Araldite mixture is, perhaps, still the resin of choice if both good tissue preservation and ease of sectioning are required.

1. **Glauert A M, Rogers G E & Glauert R H.** A new embedding medium for electron microscopy. *Nature* 178:803, 1956. (Cited 180 times.)
2. **Luft J H.** Improvements in epoxy resin embedding methods. *J. Biophys. Biochem. Cytol.* 9:409-14, 1961. (Cited 10,500 times.) [See also: **Luft J H.** Citation Classic. (Barrett J T, ed.) *Contemporary classics in the life sciences. Volume 1: cell biology.* Philadelphia: ISI Press, 1986. p. 3.]
3. **Mollenhauer H H.** Surfactants as resin modifiers and their effect on sectioning. *J. Electron Microsc. Tech.* 3:217-22, 1986.

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