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Parker R E & Isaacs N S. Mechanisms of epoxide reactions. *Chem. Rev.* 59:737-99, 1959.
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This review is concerned only with the three-membered-ring α- or 1,2-epoxides, all of which can be regarded as derivatives of ethylene oxide. [The *SCI*® indicates that this paper has been cited in more than 865 publications.]

A Review of the Glue

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The background to the writing of this review goes back to the glue industry of the 1950s. The senior organic chemist at the University of Southampton at that time was Norman B. Chapman, who was well known for his mechanistic work. His graduate student Roy Bishop, after receiving his PhD, went to work for a local chemical company, Leicester-Lovell, which manufactured casein glues. This firm was a Borden (the American milk corporation) subsidiary. The casein they used was, of course, made from milk. Now about this time, the firm began to diversify into other adhesives and resins, in particular the epoxy resins. These are manufactured from bisphenol-A and epichlorohydrin to give a linear polymer terminated by epoxy groups. At this stage, the material is a viscous liquid, cross-linked by reaction with an amine causing setting into a hard solid, with good adhesion to many surfaces. This is familiar today in the household epoxy adhesives, such as Araldite, which are supplied in two tubes. The company realized that little was known about the mechanism of cross-linking. Bishop suggested that Chapman initiate some research on the subject.

A graduate studentship was proposed and subsequently awarded to me, at that time an undergraduate in the Southampton department. In 1955, I embarked on a PhD program, under Chapman's guidance, on the topic of the kinetics and mechanism of the reactions between epoxides and amines. We planned to use simple epoxides and models of the terminating groups of the resin and to carry out all the usual physical-organic methods of investigation. Matters were complicated somewhat by Chapman's elevation to professor of organic chemistry at the University of Hull, at the other end of England. As my project was rather closely tied to Leicester-Lovell, I was to remain in Southampton. Responsibility for supervision of the work was given to R. Eric Parker, then a junior lecturer in the department and a former student of Chapman.

Parker's background had been in aromatic substitution, and so it turned out that neither of us knew a great deal about epoxides. Parker's decision that we must first know the background of the subject was typical, and I was sent off to the library for a few weeks to research all the known chemistry of epoxides. This, in those days, was not the formidable task that would face the information technologist today. *Chemical Abstracts* was only a few volumes a year, and we soon established the known facts. The results of this search guided the research project into interesting and original channels, and we decided to publish the results of this literature work. The review was written by Parker from my card index, our own new results were incorporated, and it was finished in 1958, at which time I left with a PhD.[1,2]

Subsequently, I spent several years in North America before returning to a position at the University of Reading. However, I did not continue to work on epoxides (see reference 3); Parker did continue the project with Robert Laird, now at Newcastle, who applied Hammett relationships to the reaction. Parker subsequently left academic life to become secretary to the Royal Society of Chemistry and, sadly, did not live long after. Chapman happily is well after seven years of retirement and enjoys grumbling at the passing of the type of university that we knew in its heyday—the 1960s.

1. **Chapman N B, Isaacs N S & Parker R E.** The mechanism of epoxide reactions, part I; the reactions of 1,2-epoxyethylbenzene, 1,2-epoxy-3-phenylpropane and 1,2-epoxy-3-phenoxypropane with secondary amines. *J. Chem. Soc.* 1959:1925-34, 1959.
2. **Isaacs N S & Parker R E.** The mechanism of epoxide reactions, part II: the reactions of 1,2-epoxyethylbenzene, 1,2-epoxy-3-phenylpropane and 1,2-epoxy-3-phenoxypropane with benzylamine. *J. Chem. Soc.* 1960:3497-505, 1960.
3. **Isaacs N S.** *Physical-organic chemistry.* Harlow, England: Longman, 1987.

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