Cold shortening strongly affects meat tenderness. As shortening increases from 20 to 40 percent of initial muscle length, a severalfold toughening occurs; it is reversed (by tissue rupture) with further shortening. Maintenance of musculoskeletal attachments does not necessarily prevent localized shortening and toughening. [The SCF indicates that this paper has been cited in over 145 publications since 1966, making it the most cited paper published in this journal to date.]

B.B. Marsh
Muscle Biology Laboratory
University of Wisconsin
Madison, WI 53706

October 3, 1983

"Frozen lamb has long provided much of New Zealand's export earnings, so complaints were taken very seriously when strongly expressed by overseas buyers in 1961. The meat industry turned to the young and still small Meat Industry Research Institute for help, and a major study of the problem was initiated. The troubles was soon traced to two recent changes in packinghouse practice: the installation of blast freezers and the elimination of a previously imposed delay of several hours before carcasses entered the freezers. Separately, these modifications were shown to be without effect; together, they could (and frequently did) convert the normally tender meat into a virtually inedible product.

"After fruitless efforts to explain the toughening, we put into account. Toughness occurrence, henceforth, was a little less unpredictable. Later, it led to an observation of rather greater significance, for during a 1970 follow-up to the investigation, Bill Carse and I commenced a study of the effects of carcass electrical stimulation on glycolytic rate and cold shortening (reported by Carse). Outside New Zealand, however, nothing was known of these background matters, or of the real reason for the institute's interest in tenderness; the industry refused to permit any mention of its toughness difficulties in our publications, lest an acknowledgment of the problem's existence might depress overseas lamb sales.

"For this reason, I am surprised that the paper has received so much attention, since, deprived of its clear and immediate warning to the meat industries of other countries, the report must have appeared as little more than a confirmation and extension of earlier institute observations. Perhaps the frequent citation is due to the relative order it brought to a rather chaotic scene, demonstrating that a somewhat tidier tenderness pattern emerged when shortening was taken into account. Toughness occurrence, henceforth, was a little less unpredictable.

"Cold shortening and its toughening consequences have not been reviewed in depth for some years, but will be discussed in several chapters of a forthcoming book."