Read and McLeish Reply: In our Letter [1], we proposed that lozenge patterns arise from a combination two populations of chain material, one constrained and the other orientationally unconstrained by network crosslinks. Any model involving a proper combination of these two populations will yield lozenges. To illustrate this argument we chose the simplest such model: a chain whose central portion could be directly deformed but whose ends were orientationally unconstrained. In this model, the physical mechanism giving rise to the lozenges is readily apparent. We are confident that a detailed description of the networks used in the work of Westermann *et al.* [2–4], taking proper account of effects such as chain scission, will give sensible fitting parameters while retaining the quality of the fit and the physical origin of the lozenges.

A correct understanding of chain scission is vital. As a network is formed, crosslinking and chain scission occur simultaneously. There are many more crosslinks than scissions, so most chains are crosslinked to the network before they are broken. As in Fig. 1, the two half-chains remain correlated in a volume of similar size to the original melt chain. SANS perceives the two half-chains as a single chain, so chain scission gives a minimal perturbation to the apparent R_g [in direct contradiction to point (3) of the Comment [5]]. This reflects a weakness in the calculations of Westermann *et al.* for the effect of chain scission on scattering [4]. They assume that all chain scission occurs at the start of the reaction, the two halves of a broken chain exploring a large volume before being crosslinked, thus giving a strong effect on the apparent R_g. In this way, Westermann *et al.* significantly underestimate the total quantity of chain scission. The work of Brereton *et al.* [6] actually shows that quenched constraints affect scattering at the q range corresponding to their correlation length. In his case this length was R_g, but in our case it is the tube diameter d.

We are grateful for the further fits to data by Westermann *et al.* because they force us to consider the remaining discrepancies between our simple model and the real network. It is clear why our model gives a small value for the tube diameter when applied to a complicated system. There are two important pieces of information carried by the scattering curves: (a) the fraction of orientationally unconstrained material, and (b) the typical deviation of an "average" monomer from its mean position. In our model, (a) is related to the dangling end fraction f alone. Chain scission and loops give rise to more unconstrained material than would otherwise be expected, and so f is high. (b) is related both to the tube diameter d (the constraint on the central chain section) and to f. Our model concentrates the unconstrained material into two large dangling ends per chain. In order to get (b) correct, the model compensates the freedom of the large dangling ends by decreasing d, putting a greater constraint on the central deformed chain. A more accurate (but analytically complex) model would treat the greater number of (small) dangling ends from chain scission explicitly, and would not require as tight a constraint on the deformed chain.

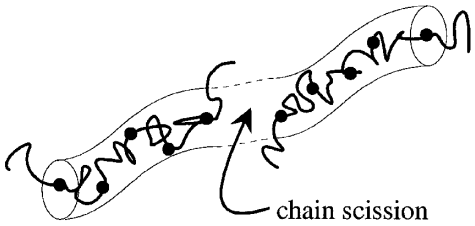

Fig. 1. Scission gives two "half-chains," correlated in space with four dangling ends in total.

We do not discount the possibility that the tube diameter couples to strain (although the tube potential must be isotropic for exact reproduction of the isotropy angle). We recently explored the consequences of anisotropic potentials [7], finding that the data available to us were well described by either isotropic or anisotropic potentials. It may well be that the full weight of all existing data indicates anisotropic potentials. However, the scattering formula used by Westermann *et al.* [2,4] does not represent a proper use of the RPA and cannot be derived from *any* microscopic physical model: they do not have a valid candidate for the lozenge pattern.

D. J. Read and T. C. B. McLeish
Department of Physics, University of Leeds
Leeds LS2 9JT, United Kingdom

Received 11 November 1997 [S0031-9007(98)06318-2]
PACS numbers: 61.41.+e, 61.12.Bt, 83.80.Dr

[1] D. J. Read *et al.,* Phys. Rev. Lett. **79**, 87 (1997).
[2] E. Straube *et al.,* Phys. Rev. Lett. **74**, 4464 (1995).
[3] E. Straube *et al.,* Macromolecules **27**, 7681 (1994).
[4] S. Westermann *et al.,* Macromolecules **29**, 6165 (1996).
[5] S. Westermann *et al.,* preceding Comment, Phys. Rev. Lett. **80**, 5449 (1998).
[6] M. G. Brereton *et al.,* J. Phys. I (France) **2**, 581 (1992).
[7] D. J. Read *et al.,* Macromolecules **30**, 6376 (1997).

 0031-9007/98/80(24)/5450(1)$15.00