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Letter to the Editor

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Letter to the Editor

We write to respond to the letter by Drs Simon-Hettich and Becker regarding our published manuscript 'Non-toxic thermotropic liquid crystals for use with mammalian cells', Luk *et al.*, 2004, *Liquid Crystals*, **31**, 611 (2004). Their letter raises the issue as to whether cytotoxicity of liquid crystals was established in our study because we did not create a traditional dose response curve by evaluating a range of concentrations of mesogens in culture media. We agree that our approach does not follow the procedures outlined in the reference cited by the authors. We note, however, that the technological applications we envisage for cells and liquid crystals require the contact of cells with neat liquid crystal, and thus our publication in *Liquid Crystals* characterized the toxicity of liquid crystals under the conditions relevant to this envisaged application. We also note that we carefully defined our experimental conditions and present data that support our conclusion that some thermotropic liquid crystals (e.g. TL-205) when contacted (as neat, undiluted materials) with cells attached to surfaces demonstrate no appreciable toxic effects on cells over a four hour exposure period, while others (e.g. 5CB) kill cells under identical conditions.

We concur with their speculation that the underlying mechanism leading to the deleterious effects of the liquid crystals on the cells may indeed be influenced by the physical properties of the liquid crystals. The thermotropic liquid crystals we evaluated are not uniformly water soluble and attempts to put them into solution in culture media using standard approaches (e.g. sonication and heating) were unsuccessful. Testing serial dilutions of LCs that do not dissolve in culture media was not relevant to our study, which sought to screen a variety of LCs in the hope of finding compounds that would exhibit minimal or no untoward effect when in contact with cells while retaining their intrinsic liquid crystallinity. With the latter goal in mind, we were successful in identifying a class of perfluorinated liquid crystals as being compatible with maintenance of normal cell function.

Subsequent to our original publication, we have conducted further studies that show TL205 liquid crystals to have little effect on cells after 24 hours of exposure. Similar to our previous findings, we have also found that 5CB is not compatible with maintaining cell viability. To perform these experiments we grew SV-40 human corneal epithelial cells to confluence on transwell filter membranes. We then removed the culture media from the apical surfaces of the cells while maintaining media in contact with the underlying surface of the membrane, thus allowing the cells access to the culture media from their basal surface. The apical surfaces of the cells were then coated with thermotropic liquid crystal (TL-205 or 5CB). After 24 hours, the cells were stained with Calcein AM (Molecular probes) which serves as an indicator of cell viability as detailed in our original publication. The effects are shown in figure 1.

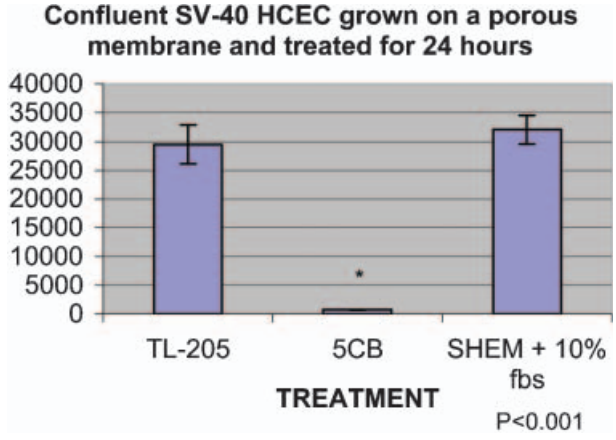

Figure 1.

Remarkably, we found TL-205 to support cell viability equivalent to culture media containing 10% serum. In contrast, cells exposed to 5CB under identical conditions died. The finding that there exist thermotropic liquid crystals that are compatible with maintenance of viable cells over extended periods of exposure suggests the possibility that liquid crystals may emerge as an important tool for the study of cell behaviour.

Sincerely,

Christopher J. Murphy and Nicholas L. Abbott

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