

## Author's reply

Elitza I. Tocheva, Davi R. Ortega and Grant J. Jensen

In regard to the comments on our Opinion article (Sporulation, bacterial cell envelopes and the origin of life. *Nat. Rev. Microbiol.* **14**, 535–542 (2016))<sup>1</sup>, by Iain C. Sutcliffe and Lynn G. Dover (Comment on Tocheva *et al.* “Sporulation, bacterial cell envelopes and the origin of life”. *Nat. Rev. Microbiol.* <http://dx.doi.org/10.1038/nrmicro.2016.113> (2016))<sup>2</sup>, we wholeheartedly agree that it will be interesting to see how our hypothesis holds up to future discoveries of new and potentially different phyla, and said so ourselves in the ‘evolutionary implications’ section of our article.

The first paragraph of the Correspondence by Sutcliffe and Dover can give the impression that we limited our analysis to only certain phyla. We reiterate that we based our analysis on the most comprehensive tree available to date that was generated by methods designed to discern ancient relationships between phyla<sup>3</sup>. This tree includes all structurally characterized phyla. Although many new phyla have now been reported (for example in REF. 4), none of these phyla has been structurally

well-characterized, which precluded the inclusion of these phyla in our analysis of cell plans. Regardless of what is discovered in the future, our hypothesis is at least an intriguing explanation for the diversity that is observed within the phyla that have already been characterized, all of which are included in our analysis.

Sutcliffe and Dover list more details in their correspondence than we did in our Opinion article about the unique characteristics of the mycolic acid-based outer membranes that suggest these outer membranes may have evolved independently. We were aware of these characteristics and highlighted the most important ones ourselves, and then stated quite clearly in the ‘evolutionary implications’ section “Alternatively, of course, the mycolic envelope is different enough that it may have evolved independently.” It is a matter of opinion at this point whether a substantially different outer-membrane structure such as that of mycobacteria is more likely to have arisen through a completely independent evolutionary path or through the adaptation of an

existing outer-membrane structure. We favour the latter. What would advance the conversation now would be a mechanistic proposal for how such a different outer membrane might have arisen, if not through a sporulation event.

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### Competing interests statement

The authors declare no competing interests.