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Professor G. Keisel, F.R.S.  
Department of Philosophy  
Stanford University  
Stanford, CA 94505

Dear Kreisel,

Thank you for the three papers. I had already read your piece about Bertie Russell when it came out. I have never been able to understand mathematical logic, but I enjoyed the less technical parts though I felt rather like a vegetarian being offered a ham sandwich. I read through the Essay on Wittgenstein, again being unable to follow much of the mathematical part though I got the general flavor. It seems to me that your style, which was well controlled in the piece for the Royal Society, have become a bit fragmented. In writing about Wittgenstein, whether this was the influence of the master or not I am not at all clear. I hope you'll forgive me for not attempting the piece in German because, as you know, I have little French and less German.

As to the two footnotes I was amused to see your remarks about "Codes Without Commas" as I am rather fond of using this example myself. Even at the time we were rather doubtful about this particular idea although it was obviously rather pretty. It was first circulated as a private note and only published in PNAS because four people asked if they could quote it. The difficulty was, as we realized then, that the only thing in its favor appeared to be that we gave the magic number 20 but it was easy to see that any theory which did not give this number would have been rejected, so this could hardly be taken as evidence in support of it. Before long it became apparent that rather than evidence accumulating in its favor the experimental data was running the other way. In particular the wide variation in base composition of DNA from different microorganisms was hard to reconcile with this sort of code. It was, of course, finally killed by our work on the acridine mutants.

The other idea you mention, that of directed panspermia, also lacks any serious scientific support. Unfortunately the remarks about Molybdenum have turned out to have no foundation because the abundance of this element in sea water is very different from what it is in the soil. We are thus left with nothing to back up this rather "way out" idea. There is indeed one quite good argument against it. If we were to send microorganisms to a distant planet, we would almost certainly send a mixture of prokaryotes, the simple microorganisms, and eucaryotes, the more complicated ones of which yeast is an example.

Professor G. Kreisel, F.R.S.

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The evidence from the fossil record, which is rather thin, suggests that the eukaryotes arose on the earth very much later. Thus if the idea of panspermia is correct, either no eukaryotes were sent or they died out shortly after their arrival. You can see that this does not exactly give us confidence in the idea. I think the real lesson from this exercise in imagination is that the subject is in such a backward state that one cannot refute theories of this sort at this time. In fact the origin of life may be one of those scientific problems which may take a very long time to yield a satisfactory answer and indeed may never do so. At the moment it certainly needs some sort of lucky breakthrough, such as the discovery of a common mineral with helpful catalytic activity, if it is to make any progress.

Best wishes for Christmas and the New Year,