SCHOELL AND WELLMER REPLY— Towe has raised some often repeated questions which, however, are not directly relevant to our paper. We aimed to explain why some Precambrian graphites are depleted in ^{13}C compared with the bulk of all other Precambrian graphites. We offered an explanation by suggesting local phenomena such as CO_2 from oxidized methane as a food source for the original biota, rather than worldwide phenomena or completely different geochemical processes. However, Towe's comment indirectly bears on our argument and deserves a brief reply.

Two questions have been raised: why some organisms, specifically marine algae, are enriched in ^{13}C compared with common kerogens; and why Precambrian and early Phanerozoic kerogens are isotopically more enriched in ^{13}C as compared with modern marine algae and algal mats.

These problems have already been discussed by previous workers[1,2], who concluded in part that marine algae as found today could not have been the predominant precursor of Precambrian reduced organic matter. Recent work on the Precambrian argues for an establishment of a flourishing yet primitive life already 3,500 Myr ago[3,4]. Detailed work on marine phytoplankton[5] revealed a range of carbon isotope fractionation between HCO_3^- and organisms ranging from −22 to −35‰ (the mean of which interestingly is −27.5‰). The carbon isotopic composition was found to depend on the species and on local conditions (pool size effect). The above figures easily explain the range of 'normal' Precambrian reduced organic matter.

The observation of relatively heavy carbon in less than half a dozen modern algal mats hitherto investigated does not justify the general statement of Precambrian organic matter as being 'disturbingly anomalous'. On the contrary, we emphasize the isotopic similarity of Precambrian, Phanerozoic and recent organic matter and consider this similarity as an argument for the early establishment of biological carbon fixation based on the presently operating enzymatic pathways, that is as proof for (1) the extreme antiquity of CO_2 fixation (notably by the RuBP carboxylase reaction) and (2) the constancy of the isotopic composition of the Earth's pool of inorganic carbon (atmospheric CO_2 and marine bicarbonate).

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Are monozygotic twins similar due to genetic factors alone?

THE number of errors and inconsistencies in the paper by Gärtner *et al.*[1] raises doubts about the validity of their conclusions. In Table 1, the mean and standard deviation of 51-day-old monozygotic (MZ) males are incorrect and differ from the mean and standard deviation for the same data given in Table 2. For 51-day-old dizygotic (DZ) males the authors estimate the between-pairs component of variance as +1.18 when the correct value is either zero, since it is not significant, or negative. This error is repeated for the same data in Table 2 where in addition, the same error is made for body weight of DZ males, aged 61 days. Also in Table 2, the F ratios between estimates of the variance components s_b^2 for MZ and DZ twins are incorrect. The ratios are not F tests; the degrees of freedom attributed to them are incorrect as are, therefore, the probabilities. Furthermore, for reasons which are not discussed in the text and which are not obvious, these probabilities appear to be one-tail. Even if the between-pairs items had been compared using correct tests, it is difficult to see what conclusions could have been drawn for the many characters for which, according to Table 2, MS_ws differ significantly between MZs and DZs.

Incidentally, the estimates of MS_w cannot take the extremely small values that are given in Table 2 unless their true values are zero and the values given are rounding-off errors or arbitrary. The assumption of "random effects" is superfluous for the analysis used, and an explanation is required for pooling males and females for some characters and omitting females for others when the authors say that all statistics were calculated separately for males and females.

Finally, there are features of the data which are difficult to reconcile with the explanation given by the authors. For example, examination of body weight in females from 31 to 61 days shows that the DZs, as expected, retain their initial level of variability as reflected in the total variance. Indeed, this variance increases slightly with age. In complete contrast, on the same criterion the MZs are as variable as the DZs at day 31, but lose their variability as they age. Indeed at day 61, they display almost no variability at all. Since the main conclusion of this paper is that there is a lower level of variation within the MZs than the DZs and that this can be attributed to events that occur early in life, it is difficult to see why these MZ females reached their maximum variability early in life and their minimum as adults.

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GÄRTNER AND BAUNACK REPLY— Our results[1] show that pairs of sexually concordant isogeneic DZ twins differ more than pairs of MZ twins because of a non-genetic mechanism which modifies each zygote differently before the third cell division. We thank Jinks and his coworkers for drawing attention to a few errors in our paper. However, these errors do not affect our conclusion as the similarity within the pairs of MZ is clearly much greater than that within DZ twins of inbred mice whatever the method of statistical analysis. Therefore the valid criticism of Jinks *et al.* of the F values for testing the between variance components (s_b^2) does not influence our main conclusion. Nor do the two regrettable errors they mentioned in printing different numbers in Tables 1 and 2 for the 51-day MZ body weights and the absence of the minus sign for the DZ 51 and DZ 61 variance components.

Further discussion of the statistical procedure helps only to a very small degree. To shorten this discussion we are prepared to send to any interested scientist our original data for statistical analysis by a method of his/her own choice.

We do not accept the other criticisms. The first three variables of Table 2 (appearance of the hair, eye opening, ear opening) are data measured in whole days. All the MZ pairs exhibited the event on the same day. It seems unrealistic to compare the alteration of the variance in the MZ female twins as Jinks *et al.* suggest, because of the very small numbers of female MZ twins.

Further confirmation can only come from the results of similar experiments in other laboratories. However, further experiments in our own laboratory using twins produced since our original paper, together with many additional characters, support our conclusions.

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