Swanscombe came from the Middle Gravels but those from Purfleet came from a shell band which is ~1 m or more below the main or Middle Gravel at that site, immediately above a coarse sandy orange-brown gravel, referred to as Gravel 3. Very few artefacts came from this Lower Gravel, but some of Clactonian aspects were present. It can, therefore, be suggested that the whole series of deposits at Purfleet are comparable to those at Swanscombe. As the amino acid ratios from Purfleet refer to deposits which are stratigraphically somewhat older than the Middle Gravel at Swanscombe, the discrepancies in the ratios can possibly be explained on this basis as dating slightly different phases of the same interglacial.

Andrews, Bowen and Kidson[2] pointed out that the Portland Raised Beach and Burtle Beds have produced ratios which do not agree exactly with those of Middle Hope and Minchin Hole, all frequently assigned to the last interglacial. There may be several explanations for these discrepancies. Attention has often been drawn to the fact that there are pronounced altimetric differences between the Beach deposits in various parts of the Bill area of Portland, and it has recently been pointed out that there may be at least two quite distinct raised beaches on the Isle[4]. Here again, different phases of the same interglacial may be involved, indicating minor advances and regressions of the sea.

On the other hand, other environmental factors could possibly be involved, as suggested by the ratios of the Holocene sample from Portland. This sample came from the Mesolithic habitation site of Culver Well, with a very large shell-midden with uncalibrated radiocarbon dates of 5200±135 BC (BM-473) and 5151±97 BC (BM-960); a weighted average of three samples of burnt limestone from a hearth has given a thermoluminescence date of 5400 BC±640 (OxTL 501 b, m)[5]. The stratigraphical evidence and archaeological finds from the midden clearly indicate a dating within the Mesolithic period, falling within the Atlantic climatic zone. The other Holocene sample came from Skara Brae in the Orkneys, a site known from the archaeological evidence to belong to the late Neolithic period associated with pottery of the Rinyo type, that is this site is at least 3,000 yr younger than Portland (or less than half the age of the Mesolithic site). Yet both sites have produced D-allo: L-iso (combined) ratios of 0.04, indicating that results from one or the other, or perhaps even both, the Holocene control samples are unreliable. This too could possibly be explained by different environmental or economic circumstances relating to the sites, during the relevant prehistoric periods and after, affecting the epimerisation reaction of the samples. Or it may be that the sensitivities of the techniques are not yet so advanced that differences of only a few thousand years can be registered.

These discrepancies do not, however, minimise the great value of the work being done on amino acid reactions as potential chronological indices.

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MILLER *ET AL* REPLY—Our *Corbicula* from Swanscombe are not from, but merely correlated with, the Middle Gravels there. If the correlation is correct, then the absence of *Corbicula* in the Swanscombe Lower Loam and Lower Gravel, at an elevation intermediate between the Middle Gravels and Grays (with similar ratios), suggests that the Lower Loam and Lower Gravel may be from an older interglacial. The *Corbicula* at Purfleet could be from early in the Middle Gravels interglacial, or from another interglacial, intermediate in age between the Middle Gravels and Lower Loam–Lower Gravel ones.

At current temperatures in Britain, amino acid epimerisation occurs slowly; hence, as Palmer infers, we cannot detect as yet differences of a few thousands of years. This does not mean that such discrimination is not possible. Instrumentation is improving rapidly, and there are several different reactions that may give the resolution required.

Ours[1,2] are preliminary analyses: our papers have demonstrated that amino stratigraphy will provide a useful time-frame for UK Pleistocene studies. To that end, we would like to say that we are very willing to cooperate with UK researchers on problems where this technique may be applicable.

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Asymmetry in relatedness: who is related to whom?

FLESNESS[1] has brought out the interesting fact that relatedness between diploids can be asymmetric, as it is between the sexes of male-haploids[2]. His note, however, contains a conceptual difficulty. This concerns the directionality of relatedness in his otherwise valuable definition. Because relatedness calculations are usually made in order to determine the (theoretical) optimum course of action of a potential altruist *vis-à-vis* a particular recipient, we suggest that the quantity implied in the phrasing 'relatedness of recipient to donor' should be the genetic similarity of the recipient to the donor, but under Flesness's definition it is the genetic similarity of the donor to the recipient. If weighing up (in terms of relationship) the benefits of being altruistic towards someone, you should care about the proportion of your genes that is present in him, and not the portion of his genes present in you. We therefore redefine Flesness's coefficient:

$$R_{B(A)} = \text{relatedness of B to A} = \frac{\text{(mean identity by descent of A's genes with B's gametes)}}{\text{(mean identity by descent of A's genes with A's gametes)}}$$

This directionality is also the same as that adopted by Hamilton[3] in discussing essentially the same parameter. As a consequence, the values given in Flesness's table should be reversed.

$R_{B(A)}$ (as defined above) has the same meaning as the 'pedigree coefficient of relatedness', $G_{B(A)}$ (ref. 2, and R. Frankham, in preparation), and is also similar to the 'regression coefficient of relatedness', $b_{B(A)}$ (ref. 3) (with the subscript order reversed here to conform with standard regression notation). We suggest that $G_{B(A)}$ be retained for use as the central measurement of relatedness in pedigrees (as $R_{B(A)}$ is more easily confused with Wright's[4] 'coefficient of relationship', r), and that Hamilton's coefficient be retained for estimates of relatedness derived by regression analysis of populations (P.P. and R.H.C., in preparation).

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