Fetal Mortality and Sex Ratio

McMillen (1) may be correct in "conservatively" estimating the primary ratio of human male to female conceptuses to be at least \( Y_1 = 100 \) among males, but the use of ratios \( y_1 = 100 \) only, that the reference to certain interests, \( y_1 \) defined below, the other variables as in \((1)\):

\[
y_1 = \frac{y_2}{d(y_2 - 1) - f + 1}
\]

where \( f \) = proportional female zygote loss, "reported" to be \( \hat{f} \) between 0.4 and 0.5; \( d = m - f \) = excess male-over-female mortality ratio, "observed" to be between 0.04 and 0.18; \( y_2 \) = the proportion of live-borns that are male, the male secondary sex proportion, observed to be between \( 0.515 \) and \( 0.5131 \) for the later (1950 to 1972) for two sets of data used in her analysis. With this equation for \( y_1 \), the cited ranges of \( f, d, y_2 \), and the definition of \( y_1 \), we obtain \( Y_1 \) values between 110 and 165; this range is quite close to the previous estimates, 110 to 170, that McMillen cites in her first paragraph. Thus she has not succeeded in reducing the primary range of uncertainty regarding the primary sex ratio.

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References
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McMillen's (1) study of fetal mortality and her estimate of fetal sex ratio serve as a reminder of the difficulty of obtaining accurate data on the sex of aborted fetuses. The tables she has used for fetal mortality (2) are compiled from fetal death certificates and are inevitably fraught with uncertainty. On these certificates sex is recorded on the basis of morphological criteria, which are notoriously unreliable, especially as early as 3 months of gestation; and throughout gestation these criteria will give inaccurate or ambiguous indications of sex when external genitalia are abnormal. Many of the tables of the study report large numbers of fetuses of unknown sex, and it cannot even be certain that those classified as males and females are what they seem to be. Cases of polyploidy and sex chromosome aneuploidy, such as Turner's (XO) and Klinefelter's (XXY) syndromes, which lack the normal sex chromosome constitution, should be eliminated from a rigorous study of fetal sex ratio. But there is no way of knowing how they have been classified in these tables.

It seems unlikely that such uncertainty will be overcome until first-hand data on fetal mortality are available from a systematic study of the karyotypes of spontaneous and induced abortions, examined by modern staining techniques. Although there have been several large-scale studies done along these lines, the published reports (3, 4) are inadequate for a confident count of sex ratio. Because the major purpose of these studies was usually to look for abnormal karyotypes, only one report (4) gives full details of the rest of the population studied, and information about gestational age is sparse.

A Terminal Mesozoic Greenhouse

McLean (1) has postulated a significant global warming trend during late Maastrichtian time; this warming trend, he suggests, led to wide-scale extinctions of terrestrial faunas and marine plankton. We question two aspects of McLean's argument.

First, McLean (1) cites Voight's (2) data on the distribution of rudists and other marine invertebrates as evidence for a "cool early Maastrichtian [sic] with subsequent warming in late Maastrichtian." Polšak (3) used \(^{18}O / {O}^2\)O ratios to determine water temperatures from 139 Cretaceous limestone (41) and fossil (98) samples from the Dinardian and Slovenian Alp. Paleotemperatures obtained in this work are shown in Table 1. These data show that in the Tethyan seaway, water temperatures were highest in Santonian to late Campanian time, declined slightly during late Campanian through middle Maastrichtian time, and declined by 5°C during late Maastrichtian time.

Second, McLean (1) states, "Warming of the earth's surface would warm the oceans. As the water warms, the solubility of CO2 decreases and it is driven from the oceans into the atmosphere." McLean considers only one factor, the other being precipitation of calcium carbonate when the saturation value of CO2 is exceeded in warmed waters. The exact balance between precipitation and loss to the atmosphere is not now precisely known. However, it has been shown (4) that degassing of CO2 is accompanied by precipitation of carbonate in modern marine environments. Hence, precipitation of large volumes of calcium carbonate would be expected to have accompanied McLean's Maastrichtian warming. Further, these large quantities of readily available calcium carbonate would not have caused solution of the calcareous shells of marine protists. Had warming occurred, we would expect the late Maastrichtian distribution of such protists to be geographically enhanced, and that the abundance of these fossils would have been significantly increased. Polšak (3) also shows this relationship with reference to the stenothermal rudists.

Table 1. Paleotemperatures of Tethyan sea (3); B.P., before present.

<table>
<thead>
<tr>
<th>Geologic age</th>
<th>Water temperature (°C)</th>
<th>Approximate age (10⁶ years B.P.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late Maastrichtian</td>
<td>18.5</td>
<td>67</td>
</tr>
<tr>
<td>Late Campanian-middle Maastrichtian</td>
<td>25</td>
<td>80</td>
</tr>
<tr>
<td>Santonian-late Campanian</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td>Coniacian</td>
<td>24</td>
<td>100</td>
</tr>
<tr>
<td>Late Turonian</td>
<td>16</td>
<td>105</td>
</tr>
<tr>
<td>Early Turonian</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td>Cenomanian</td>
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<td>100</td>
</tr>
<tr>
<td>Albion</td>
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<td>100</td>
</tr>
<tr>
<td>Aptian</td>
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</tr>
<tr>
<td>Burrenian</td>
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<td>100</td>
</tr>
<tr>
<td>Neocomian</td>
<td>16</td>
<td>100</td>
</tr>
</tbody>
</table>

The data on which credible values for fetal sex ratio can be based are not likely to emerge from the archives: they have yet to be published.

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References
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