0.1 per cent milk¹. It would seem that phagotrophy in *O. marina* and *P. trichophorum* is due to different causes.

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¹ Chen, Y. T., *Quart. J. Micr. Sci.*, 91, Pt. 3, 279 (1950).

The Australopithecine Milk Canines

WE have previously discussed^{1,2} the classification of lower milk canines by multivariate statistical analysis. By this means we have shown that the Taungs and Kromdraai specimens found in South Africa are neither those of chimpanzees, gorillas nor orang-utans and that, in tests based on four carefully chosen dimensions of the specimens, they cannot be distinguished from the teeth of humans.

By the courtesy of Mr. J. T. Robinson, we have now been able to apply these methods to six other lower milk canines found in South Africa. One of our tests^{1,2} employed the discriminant function,

$$X = x_1 - 7.49x_2 + 2.34x_3 + 4.70x_4,$$

where x_1 is the height, x_2 the maximum anterior-posterior length of the upper half, x_3 the maximum breadth of the upper half, and x_4 the maximum anterior-posterior length at the level of the basal cingulum of the specimen (all measured in millimetres). The values of X for all eight fossil specimens are given in column 1 of the accompanying table. All are negative; that is, all fall outside the range for apes² and within the human range. We can therefore conclude definitely that none of these teeth can be assigned to the apes; and, tentatively, that they are of hominid origin.

	X	S
Kromdraai	-2.6	1.0
Taungs	-7.9	5.9
Swartkrans SK 61 (left)	-5.9	2.3
Swartkrans SK 61 (right)	-9.1	6.7
Swartkrans SK 62	-7.5	6.7
Swartkrans SK 63	-5.4	4.9
Sterkfontein (left)	-2.4	11.9
Sterkfontein (right)	-4.4	10.6

The second conclusion remains tentative so long as the tests are confined to the discriminant X . For the discriminant is essentially a comparative test: a device to decide which of two or more stated alternatives is to be preferred. The analysis was therefore pressed further, to discover how closely, in an absolute sense, these teeth resemble human milk canines.

This question is answered by a second multivariate function, the generalized distance. This statistic sums up, in one quantity, the divergence of the complete set of measurements of the specimen from their means in the group with which it is being compared (making allowances for the variances of the measurements and the correlations between them). It is thus a mathematical measure of the absolute resemblance of the specimen to the group as a whole.

Using the same four dimensions, x_1 , x_2 , x_3 and x_4 , and the same basic material which yielded the discriminant, we constructed² such a generalized distance function for human milk canines. Its most convenient form is the sum of squares

$$S = (y_1 - 6.53)^2 + (y_2 - 11.96)^2 + (y_3 - 4.99)^2 + (y_4 - 1.91)^2,$$

where the y 's are obtained from the x 's by the relations

$$\begin{aligned} y_1 &= x_1, \\ y_2 &= -0.345x_1 + 2.605x_2, \\ y_3 &= 0.078x_1 - 0.586x_2 + 2.337x_3, \\ y_4 &= -0.124x_1 - 1.159x_2 - 0.119x_3 + 2.050x_4. \end{aligned}$$

The value of S for a specimen is always positive, and the larger S is the smaller is the resemblance to human teeth. On the average, S will exceed 6.0 in only 5 per cent of human specimens; and it will exceed 8.4 in only 1 per cent of human specimens. (These percentages are estimated from the measurements of modern European lower milk canines. It may be expected that they would be somewhat larger if the measurements were extended to include other races.)

The values of S for the South African finds are given in column 2 of the table. They demonstrate the resemblance between these teeth and modern human milk canines. Four values of S lie within the range which encloses 95 per cent of modern human values, and two others lie close to it. The Sterkfontein pair alone is unacceptably remote; a value of S as high as these would be expected to occur in modern European man only once in a thousand times.

For completeness, we should add that the closest resemblance we have found between the individual fossils and the ape groups is between Sterkfontein (left) and the orang-utans, and this corresponds to an S -value of 13.6.

The fossil teeth, it is interesting to note, form a quite compact group. The dimensions x_1 , x_2 , x_3 and x_4 vary appreciably from one member of the group to another; but we have examined this variation, and it is, in fact, somewhat smaller (though not significantly so) than in our modern human group. The Sterkfontein teeth do not differ significantly from the others within the fossil group, and it seems possible to regard their differences from the human group merely as the outstanding symptom of a general slight departure of the fossils from the human average. The mean dimensions of the fossil group would give an S -value of 4.1, which (since we are now dealing not with an individual result but with the mean of several) is much higher than would be expected if the teeth were all modern human. The difference remains significant if we discard the Sterkfontein finds, and indeed if we confine ourselves to the sub-group of four Swartkrans teeth.

To complete the picture, we examined the resemblances between the mean of the fossil group and each of the ape-groups. We found that the closest resemblance of these was to the orangs, and corresponds to an S -value of 18.9.

To sum up, our analysis shows that the fossil milk canines, on this evidence, form a rather homogeneous group; that as a group they are very similar to those of modern European man; and that they are on the whole unlike those of the modern anthropoid apes.

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¹ Bronowski, J., and Long, W. M., *Nature*, **168**, 794 (1951).

² Bronowski, J., and Long, W. M., *Amer. J. Phys. Anthropol.*, **10**, 385 (1952).