Backcrosses between the first-generation male-sterile plants in the progeny of selfed scions and the Northern Star donor gave only male-sterile progeny, but the maximum number of plants tested per backcross was only 28. Only fertile progeny were secured from the selfs and backcrosses with the Northern Star donor of the fertile first-generation segregants in the progeny of selfed scions. Selfing the Northern Star donor likewise yielded only fertile progeny.

For several reasons these data do not permit extensive speculation about the nature of this cytoplasmic sterility. High heterozygosity of the material is likely because it is moderately self-incompatible. Large numbers of offspring of the $F_2$ are needed to establish independence of the cytoplasmic factor from nuclear genes. Low germination rates and high seedling mortality might have distorted segregation ratios. It would also be of interest to know whether longer lived scions would continue to maintain the same phenotype. The apparently autonomous behavior in the scions might be the result of a certain threshold requirement obscured by the short life of the scions. No explanation can be offered now for the better survival of fertile/male-sterile than reciprocal grafts. Experiments will be undertaken to study these and related problems.

Whatever doubts may be raised by these factors of uncertainty, the fact remains that the grafting induced changes in the fertile scion that resulted in the appearance of cytoplasmic sterility in its progeny. Although it seems most likely that this change was induced by movement of cytoplasmic sterility determinants from stock to scion, the tests do not entirely rule out other explanations. There is a remote possibility, for instance, that nutritional deficiency, which might have been induced by grafting, might cause a disturbance in cytoplasmic enzyme activity in such a way as to lead to an increase or decrease of sterility-determining entities of the cytoplasm.

RAFAEL FRANKEL

*Department of Vegetable Crops, University of California, Davis*

### References and Notes

1. E. Caspari, *Advances in Genet.* 2, 1 (1948).
2. R. B. Goldschmidt, *Theoretical Genetics* (Univ. of California Press, Berkeley, 1955), pp. 193–244.
3. F. von Wettstein, *Biol. Zbl.* 65, 149 (1946); P. Michaelis, *Advances in Genet.* 6, 287 (1954).
4. I am indebted to C. M. Rick of the department of vegetable crops, University of California, Davis, for collecting some of the data and for giving helpful criticism and advice in carrying out the experiments and in writing the present report.
5. P. Michaelis, *Züchter* 25, 209 (1955).
6. T. M. Sonneborn, *Advances in Genet.* 1, 263 (1947).
7. The lines were kindly furnished by W. Atlee Burpee Co.

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## Bony Dimensions and the Estimation of Men's Reference Weight

"Standard" body weight has been defined as the average weight for height, age, and sex. Both the term and the definition are unsatisfactory. The adjective *standard* may readily suggest that the value found in a height-weight table is not only "desirable" but "optimal." For this reason, Pett, in presenting the results of the Canadian survey (*1*), speaks simply of average weights. Only detailed studies of morbidity and mortality can yield information on the biological significance of given degrees of overweight or underweight at a particular age (*2*).

Although stature is a relatively good predictor of total skeletal weight (*3*), it is not an adequate measure of the bony framework in the estimation of reference weights. First, ordinary height-weight standards do not take into account the individual differences in the relative contribution of the legs and the trunk (plus head) to stature. Second, and more important, the lateral dimensions of the skeleton are not considered.

The need for paying attention to characteristics of "body build" other than height has been recognized, but adequate data for adults are not available. The widely circulated tables of "ideal" (later, "desirable") weights for women and men, issued by the Metropolitan Life Insurance Company, give ranges of weight at a given height for individuals of small, medium, and large frame. Unfortunately, no definition of the frame size is provided (*4*).

In the present study, which was carried out on random samples of Minneapolis firemen (*N*, 238; mean age, 41.6 years), five bony dimensions were included: stature (*S*); cristal height, as a measure of "leg length" (*L*); bicristal (*C*) and biacromial (*A*) diameters, as measures of linearity-laterality of the frame; and the biepicondylar diameter of the humerus (*H*). The width of the limb bones is of interest as a pure skeletal measure. The lateral size of the bony frame of the trunk is of consequence primarily because of the associated variation in the size of the skeletal musculature and viscera, not because of the direct contribution of the pelvic and shoulder girdles to body weight.

An equation, of the type $\hat{Y} = a + b_1X_1 + b_2X_2 + \cdots b_nX_n$, for predicting body weight (*W*) from the five bony dimensions and age (*E*) is given in Table 1. The multiple $R = 0.6487$. The *t*-tests indicate that the measure of leg length (*L*) does not contribute significantly to the accuracy of prediction. Omitting this variable, $R = 0.6469$. The resulting prediction equation is given in Table 2.

Deviations from a reference weight, predicted on the basis of bony dimensions, indicate more accurately the under- or overdevelopment of soft tissues in a given individual than stature alone. Measurements of the thickness of subcutaneous fat, from skinfolds (*5*), help us to interpret these deviations in terms of approximate body composition (*6*). Leanness-fatness is thus added to underweight-overweight as a second "dimension" in the description of human body. Women, in comparison with men, would be classified as "light but fat," while football players or steelworkers (*7*) would be typically "heavy but lean."

Table 1. Prediction of weight (*W*, in kilograms) from five bony dimensions (in centimeters) and age (*E*, in years), with *t*-tests of the significance of the beta coefficients of the predictors in a multiple regression equation. Significance levels: $t_{0.05} = 1.960$, $t_{0.01} = 2.576$, $t_{0.001} = 3.291$.

| Predicted weight | | *t*-values of beta coefficients |
|---|---|---|
| $\hat{W} = -111.704$ | | |
| +0.532 | *S* | 2.704* |
| −0.220 | *L* | 0.966 |
| +1.088 | *C* | 2.530† |
| +1.114 | *A* | 3.801‡ |
| +5.772 | *H* | 4.248‡ |
| +0.134 | *E* | 2.150 |

* Significant at the 1-percent level. † Significant at the 5-percent level. ‡ Significant at the 0.1-percent level.

Table 2. Prediction of weight (*W*, in kilograms) from four bony dimensions (in centimeters) and age (*E*, in years), with *t*-tests of beta coefficients of the predictors.

| Predicted weight | | *t*-values of beta coefficients |
|---|---|---|
| $\hat{W} = -106.074$ | | |
| +0.377 | *S* | 3.302* |
| +1.051 | *C* | 2.455† |
| +1.085 | *A* | 3.722* |
| +5.794 | *H* | 4.265* |
| +0.131 | *E* | 2.100† |

* Significant at the 0.1-percent level. † Significant at the 5-percent level.

JOSEF BROŽEK

*Laboratory of Physiological Hygiene, School of Public Health, University of Minnesota, Minneapolis*

### References and Notes

1. L. B. Pett, *Am. J. Public Health* 45, 862 (1955).
2. H. Marks, *Human Biol.* 28, 217 (1956).
3. Mildred Trotter, *Am. J. Phys. Anthropol.* 12, 537 (1954).
4. *Statist. Bull. Metrop. Life Insce Co.* 23, 6 (1942); 24, 6 (1943).
5. J. Brožek, *Human Biol.* 28, 124 (1956).
6. Committee on Nutritional Anthropometry, Food and Nutrition Board, National Research Council, "Recommendations concerning body measurements for the characterization of nutritional status," *ibid.* 28, 111 (1956).
7. A. Keys, *Diabetes* 4, 447 (1956).

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