IX.

THE "DWARF" SKELETON FROM THE ROMAN FORT AT NEWSTEAD.

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Curle (1911), in excavating the Roman fort at Newstead, near Melrose, found an almost complete female skeleton (Newstead IX) in a pit under a pile of horse skeletons. In his report on the human remains from the site, Professor T. H. Bryce says that this skeleton when articulated "stands between 4 ft. 6 ins. and 4 ft. 7 ins. high, a figure closely approximating to the stature calculated from the length of the long bones, *viz.* 4 ft. 6 ins. or 4 ft. 7 ins., according to the formula used." He adds, "Although the stature is very low, it is perhaps hardly below, for a female, the lowest possible limit in a race of average stature, and there is no reason to conclude that this individual represented the pygmy race described by Kollman. It is more reasonable to conclude that the low stature is pathological, and due to a premature union of the epiphyses." Curle's description of this individual as a "dwarf" underlines the implication, reiterated in several later references to the Newstead finds, that her stature was abnormally short. This term cannot be justified on the basis of Bryce's estimates; his lower value of 4 ft. 6 ins. (1372 mm.) falls well above the upper limit of individual dwarfism in the female as stated by Martin (1928), *viz.* 1210 mm. (4 ft. 0 in.), and only just below the boundary between "short" and "very short."

Bryce's stature estimate for the articulated skeleton can only be approximate, since he mentions that some cervical vertebræ and the foot bones were missing. Furthermore, as Pearson (1899) had already pointed out, estimates of the amount by which the height of an articulated skeleton differs from the true stature vary very widely. It seems doubtful whether, even with the most careful mounting, the stature of a skeleton could be relied on to within 1 in. (25 mm.).

Unfortunately Bryce does not state what formulæ for estimating stature he employed. Neither Manouvrier's nor Pearson's formulæ, when applied in the prescribed manner to the published limb-bone lengths of Newstead IX (Table I), yield stature estimates as low as 1400 mm., or indeed below 1450 mm. (4 ft. 9 ins.). Manouvrier's "Coefficients moyens ultimes" for females of less than 1400 mm. cadaver length give estimates somewhat greater than those obtained by the procedure for statures above this limit.

Pearson found that in four male dwarfs, none exceeding 1200 mm. in stature, his formulæ predicted a stature considerably above the true value; conversely his predictions for giants (above 2000 mm.) fell below the true stature. He derived a complex curve relating dwarf, normal, and giant statures, from which he concluded that "in the region of what may be termed sub-giants and super-dwarfs, namely, from about 180–200 cm. and 150–130 cm. a very small change in the long-bone makes a remarkable change in stature. Thus between normal individuals on the one hand, and giants or dwarfs on the other, there appears to be what may be termed a

TABLE I.

Newstead IX.—Limb-bone Lengths and Stature Estimates.

	Limb-bone lengths.		Stature estimates—(right-side bones).					
	R.	L.	Manouvrier (table).	Manouvrier (Coefficients moyens ultimes).	Pearson (formulæ).	Pearson (curve).	Pearson (Mean ratios).	Trotter-Gleser (formulæ).
Humerus	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Radius .	277	271	1468	1489	1478	1483	1348	1510
Femur .	203	200	1477	1505	1491	1517	1453	1512
Tibia .	382	379	1454	1466	1471	1493	1425	1484
Femur + Tibia .	305	301	1461	1469	1465	1464	1409	1500
	687	680	..	..	1465	..	..	1487

region of instability, in which an insignificant change in long-bone may throw the individual across a considerable range of stature." Pearson's consideration of the so-called "Neolithic dwarfs" described by Kollman and referred to by Bryce illustrates this clearly. For an individual with a femur length of 369 mm., Pearson's formulæ gives a stature of 1446 mm., and his curve one of 1454 mm.; for one with a femur length of 355 mm., the formula gives 1419 mm., the curve 1357 mm. In the case of the femur, therefore, the upper limit of Pearson's "region of instability" may be placed about 365 mm.; the limits for the other long bones cannot be so closely determined from his data. The values obtained for Newstead IX by Pearson's two methods indicates that it lies above these limits, so that the normal formulæ should be valid. Pearson pointed out that the probable error of the reconstruction of the stature of a single individual is never sensibly less than 2 cm., *i.e.* there is an even chance that the estimate is out by this amount.

Sir William Flower (cited by Pearson 1899) observed that the ratios of long-bone lengths to stature for the mean population give fairly good predictions for the stature of dwarfs; Pearson concluded that for short, but not dwarfish individuals, estimates by this method should be considerably below the true value. This is illustrated by Pearson's consideration of Kollman's data; where the estimates by Pearson's two methods agree, that obtained from the mean ratios of a modern European (French) sample is considerably lower, but where Pearson's curve gives an appreciably lower estimate, the mean ratio estimate agrees with this. Applied to the limb-bone lengths of Newstead IX, these mean ratios give stature estimates below 1450 mm. and in the case of the lower limb bones approaching 1400 mm.

The formulæ of Trotter and Gleser (1952) for American White females are claimed to be valid for statures at least down to 1400 mm. (4 ft. 7 ins.). Trotter and Gleser find that the lower limb-bones give more trustworthy estimates of stature than those of the upper limb, and that estimates from the combined length of femur and tibia are more reliable than those from either bone alone; the average of estimates obtained from several bones of one skeleton is not more reliable than the best individual estimate. They point out that formulæ based on young adult data will overestimate the actual stature to an increasing extent with advancing age; conversely, formulæ based on stature of elderly individuals will underestimate the stature of younger subjects. Trotter and Gleser's formulæ have standard errors ranging from 3·5 cm. to 4·5 cm., *i.e.* there is about one chance in three that an estimate may be out by at least this amount. For Newstead IX these formulæ give estimates generally somewhat higher than those obtained by either Manouvrier's or Pearson's methods. Dupertuis and Hadden (1952) point out that the formulæ of Manouvrier and Pearson are derived from a population (French) significantly shorter in stature than modern White Americans. They suggest that the Pearson formulæ may still be preferable for short-statured individuals.

Since all methods except that of mean ratios give estimates between 1450 mm. (4 ft. 9 ins.) and 1525 mm. (5 ft. 0 in.), it seems very doubtful whether the true stature of Newstead IX can have been as low as Bryce believed.

While working in the Anatomy Department of the University of Edinburgh, I encountered several female skeletons from Dark Age and also from late medieval or post-Reformation cemeteries in south-eastern Scotland with long-bone lengths no greater than those of Newstead IX; equally short bones also appeared among the Neolithic remains from West Kennet long barrow. Similar instances have been recorded from Lanhill long barrow (Cave 1938), among the Early Iron Age remains from Maiden Castle (Goodman and Morant 1939), and in the Anglo-Saxon series assembled by Munter (1936). Some of these individuals may have had appreciably

lower statures than Newstead IX, possibly falling between 1350 and 1400 mm., but it seems very unlikely that any of them would have qualified to be considered a dwarf according to Martin's definition. None of the authors cited appear to regard their specimens as abnormal.

The cranial measurements of Newstead IX are not abnormally small. They would justify associating this woman with a group of mesaticranial, rather small-headed individuals from Dark Age burials in south-east Scotland; other examples of the same type are included among the few Early Iron Age and Roman period skulls from this region. Such a type could have resulted from fusion of the brachycranial Bronze Age type with the longer and narrower type associated with the Early Iron Age in southern Britain (Goodman and Morant 1939). It is accordingly quite possible that the Newstead woman was not only British but local in origin.

No good evidence has yet been adduced that the population of any part of Britain, at any time since the Neolithic period, was consistently characterised by very short stature. In the Neolithic groups from West Kennet and Lanhill short individuals were found side by side with considerably taller ones; the same is true for the Dark Age cemeteries in south-east Scotland. In the Belgic War Cemetery at Maiden Castle there is a distinct gap between the three very short women and the others, but this disappears if all the Iron Age remains from the site are taken together. Munter's shortest Anglo-Saxon specimens form the lower end of a continuous range of variation. Nearly all these assemblages suggest that small women were more frequent than small men. Goodman and Morant, using Pearson's formulæ, found a mean female stature of 1532 mm. (5 ft. $\frac{1}{4}$ in.) for the Maiden Castle population, as against 1568 mm. for Munter's Anglo-Saxon series; these estimates would probably be raised if Trotter and Gleser's formulæ were employed.

At the present day, very short women are no rare sight in Scottish towns. MacLennan (1954) states that in a series of a thousand women attending an ante-natal clinic in Glasgow, 18 per cent were below 5 ft. in stature; this proportion cannot however be regarded as generally valid, since there is evidence (Tocher 1924) that the mean stature for this region is lower than that of Scotland as a whole.

Variation in stature may be due to other than racial causes, and it is difficult to discriminate between the effects of environment and the genetic constitution of the population; moreover environment may have a selective action on a population heterozygous for stature. It is also possible that in any population up to medieval times, if not later, small individuals represent generations stunted by periods of famine, the progeny of seven lean years against those of seven fat years. In a primitive economy, nutrition might also contribute to a differential stunting of the female sex, especially if women began child-bearing before maturity.

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