

Pelvic Brim and Cranial Size

By NATHANIEL WEYL

Dr J. Lawrence Angel of the Smithsonian Institution, whose pioneer discoveries in paleoanthropology and paleoprehistory are only now beginning to receive the academic recognition they deserve, published a paper in 1975 which attempts to plot the course of various significant indices of human material well-being from approximately B.C. 30,000 to the present.¹ From the skeletal evidence at his disposal, Angel has attempted to infer such salient population characteristics as lifespan, fertility, mortality for various age cohorts, dental condition and incidence of malaria. In this paper, we shall be concerned merely with Angel's evidence concerning the depth of the pelvic inlet and its possible significance in terms of the temporal and spatial distribution of cranial size.

"Since the pelvis transmits body weight to the femur heads by a curved arch (sacrum and ilia) whose tendency is to spread apart under pressure only the anterior arch of the pubic bone resists," Dr Angel writes, "pelvic depth is the diameter, reduced if pelvic bone growth is hindered by poor nutrition in childhood and this in turn can decrease the effective size of the birth canal; extra large foetuses will be more likely to die from birth trauma and also to endanger their mothers if this A-P diameter drops below 10 cm."²

As evidence of the sensitivity of the pelvic inlet to nutrition, Angel cites findings that there was a lowering of the index by about 4 units for people who were young children in England during the food shortage years of the First World War (1915-1918)³ and also data on class differences in size of pelvic brim in the United States in the 1930s.⁴

Angel reports that the pelvic inlet depth index was 84.8 during the Upper Paleolithic (B.C. 30,000) and 85.0 during the Mesolithic (B.C. 9000), but dropped sharply to 76.6 during the Early Neolithic (B.C. 6500). This deterioration was associated with a transition from a diet heavy in animal proteins to one of wild grains and also with climatic changes which spread hookworm and dysentery. The somewhat erratic course of the index during the next six millennia does not particularly concern us.

¹ J. Lawrence Angel, "Paleoecology, Paleodemography and Health," in Steven Polgar (editor), *Population, Ecology and Social Evolution*, Aldine Press, Chicago, 1975.

² J. Lawrence Angel, *op. cit.*, pp. 16-17 of reprint.

³ G. Nicholson, "The Two Main Diameters of the Brim of the Female Pelvis," *Journal of Anatomy*, Vol. 79, 1945, pp. 131-135.

⁴ J. Lawrence Angel, *op. cit.*, p. 16.

In Greece, during the transition from the archaic to the classical periods (B.C. 650), the brim had recovered to 84.5. It would decline to 81.7 during the Hellenistic era (B.C. 300), recover partially under the Roman Empire (120 A.D.) to 83.9, and make a remarkable advance to 89.0 in Byzantine Medieval times (1400 A.D.). By the Napoleonic era (1800 A.D.), Angel found pelvic brim depth average around 83 to 84. Then in modern times (U.S.A. 1960) there was an unprecedented and startling advance to 94.4. All these averages, with the exception of the U.S. figure, are based on small samples, but this is unfortunately a necessary condition of skeletal measurements in both prehistory and early times. Dr Angel's findings are shown in detail in the table.

*Pelvic brim depth index from B.C. 30,000 to the present
(J. Lawrence Angel, 1975)*

<i>Period¹</i>	<i>Date</i>	<i>No. ²</i>	<i>Pelvic Brim Depth Index</i>
Upper Paleolithic	B.C. 30,000	7	84.8
Mesolithic	B.C. 9000	6	85.0
Early Neolithic	B.C. 6500	10	76.6
Later Neolithic	B.C. 5000	1	75.6
Early Bronze	B.C. 3000	20	86.4
Middle Bronze:			
Commoners	B.C. 2000	18	81.3
Middle Bronze: Royalty	B.C. 2000	2	82.6
Late Bronze	B.C. 1500	15	78.4
Early Iron	B.C. 1150	12	78.8
Classic	B.C. 650	17	84.5
Hellenistic	B.C. 300	8	81.7
Roman Imperial	120 A.D.	10	83.9
Byzantine Medieval	1400 A.D.	2	89.0
Turkish Baroque	1800 A.D.	4	84.0
Romantic	1800 A.D.	6	83.2
U.S.A. Modern	1960 A.D.	550	94.4

¹ Period characterizations are those of Dr Angel.

² Smallness of some of the samples will materially reduce the degree of confidence which can be placed in the averages.

The pelvic brim acts as a filter through which the cranium of the neonate must pass. If the former is too narrow, the largest infant heads may be crushed or otherwise traumatized in birth, causing death or brain damage. In either event, they are removed from reproduction and the genetic capacity of the population to produce large-headed infants is correspondingly reduced from one generation to the next. Evolution thus adapts foetal cranial dimensions to the size of the pelvic brim.

Since there is evidence that intelligence is positively correlated with cranial size, we would expect a large pelvic inlet to favor the mental ability of populations and conversely.

Two other tentative conclusions suggest themselves: First, while the advance of civilization in the past century has damaged man's hereditary resources by permitting the survival of

genetically damaged individuals and thus favoring the accumulation of deleterious genes, it may have had at least one other physiological effect propitious to intellect, namely, substantial widening of the pelvic aperture and hence facilitating the normal birth of unusually large-brained infants. The second tentative conclusion is that the increase in the size of the pelvic brim in modern times may widen the intelligence gap between populations which live in modern societies and populations which live in primitive ones, between healthy and unhealthy countries, and between the meat-eaters and the grain-eaters. Nevertheless, the spectacular advances in public health which have occurred and are occurring in the so-called Third World countries may well have caused significant increase in the size of the pelvic inlet.

The first obvious question to ask is: What do we really know about the comparative cranial sizes of ancient peoples and of their modern descendants? While some of the early reports of the brain-size of Cro-Magnon man were grossly exaggerated, he was significantly larger-brained than modern man. He was not, however, necessarily larger in cranial size than the modern inhabitants of those regions in which he made his greatest cultural advances. His brain probably had an average capacity of about 1590 cc.⁵ This is a good deal larger than the current European average, but is comparable to contemporary averages of 1584 cc. for Spanish Basques and 1609 cc. for Auvergnois.⁶ Since Angel reported large pelvic brims for Cro-Magnon man at the time that he flourished in the caves of the Dordogne, these impressive cranial sizes seem in accordance with the hypothesis.

The other evidence is more confusing. Martin and Saller inform us that Fourth Dynasty Egyptians (B.C. 2650-2500) had mean cranial capacity of 1532 cc., Tenth Dynasty Egyptians (around B.C. 2100) had averages of 1440 cc., and modern Egyptians averages of 1348 cc.⁷ These differences would be highly significant if we could be sure that they were not primarily class differences. Here as elsewhere, Martin and Saller have performed an immense service in accumulating, consolidating and presenting the findings of thousands of studies of physiological anthropology, some of them dating more than a century back, but

⁵ Frank E. Poirier, *Fossil Man*, Mosby, St Louis, 1973, p. 199.

⁶ Rudolf Martin and Karl Saller, *Lehrbuch der Anthropologie*, Gustav Fischer Verlag, Stuttgart, Vol. II, 1959, p. 1210.

⁷ Rudolf Martin and Karl Saller, *op. cit.*, p. 1216; The Earlier Egyptians had a certain amount of Atlantic (Cro-Magnon) in them. The latter were more Mediterranean. This may have accounted for some or all these differences.—EDITOR.

they have not provided the detailed information necessary for an evaluation of these studies by the reader, nor are the original sources available to the great majority of students and scholars.

Martin and Saller report comparisons of modern Romans with Imperial Romans. No significant differences in brain size for either sex emerged.⁸ Finally, a comparison of skulls from the Dark Ages (fifth to eighth centuries) in Switzerland-South Germany with their modern descendants gave a significant advantage in cranial dimensions to the latter.⁹ The conclusion from all of this might be the Scottish verdict, Not Proven.

When one looks at worldwide contemporary data, there seems to be a possibly significant positive correlation between meat diet and cranial capacity. Shruballs found that Amaxosa men averaged 1570 cc. as against Broca's figure of 1462 cc. for "Negroes," 1329 for Nubians, and 1317 for Hottentots and Bushmen, all estimates being based on the shot method.¹⁰ The Amaxosa are a branch of the Bantu speaking peoples of the Republic of South Africa. They are cattle raisers and their traditional diet is heavy in animal proteins. In Asia, there is a progressive increase in brain-size from the largely vegetarian Hindus (1275 cc. for females) to the Chinese (1380 cc. for females) and then to the Buriats (1496 cc. for females).¹¹ These measurements were made with the grain and water method.

The figure given for the Buriats is fantastically high and it would imply a male Buriat average brain capacity of around 1600 cc. In fact, the Arctic peoples are almost all very large brained. Eskimos for instance average 1535 cc. for males, 1429 cc. for females. Despite some earlier theorizing and incorrectly analyzed data to the contrary, these large brains do not seem to be associated with remarkable intelligence.¹²

A tempting explanation of the large brains of Arctic peoples is simply that they evolved in an environment where agriculture was impossible and hence were confined almost entirely to a meat and fish diet. Hence, a large pelvic brim and a minimal barrier to the survival of fetuses with very large brains.

This hypothesis also seems consistent with the finding that people who evolved in hot climates tend to be smaller brained than those who evolved in cold climates. Taking Martin and Saller's tabulations for brain capacity, as measured by the grain and water method, the largest brained male averages in order of size are: Eskimo 1563, Old Bavaria 1503, Wurttemberg 1494,

⁸ Rudolf Martin and Karl Saller, *op. cit.*, p. 1217.

⁹ Rudolf Martin and Karl Saller, *op. cit.*, p. 1216.

¹⁰ Rudolf Martin and Karl Saller, *op. cit.*, p. 1210.

¹¹ Rudolf Martin and Karl Saller, *op. cit.*, p. 1211.

¹² Richard Lynn, "Ethnic and Racial Differences in Intelligence: International Comparisons," in R. T. Osborne, C. E. Noble and N. Weyl (editors), *Human Variation: The Biopsychology of Age, Race and Sex*, Academic Press, New York, 1977, pp. 273-274.

Tahiti, 1487 Alsace 1484 and the Maori 1479. The lowest are: Veddas 1250¹³, Andaman Islanders 1281, native Australians 1310, Bushmen 1324 and African Negroes 1330. Some of these differences in brain sizes are associated with, and one might say caused by, differences in physical stature, but this is not always the case and the stature differences are not sufficient to account for the variations in cranial size.

Another possible aspect of the matter is the influence of different sorts of racial adaptation to the problem of conservation of body temperature. The Mongoloid peoples, according to this theory, represent physiological adaptation to the conservation of body heat in cold regions where outside temperature is normally well below body temperature. This problem of heat conservation involves, in other mammals as well as man, a variety of structural adaptations. The one most relevant to the present problem is that Mongoloid man tends to be stocky with a minimum area of body surface in proportion to body mass. In short, he tends towards rotundity, since the sphere provides minimal surface/mass ratio. This structure is consistent with a broad pelvic brim and hence would be conducive to permitting the passage of large-brained foetuses without frequent birth traumas.

The Negroid race, according to the same theory, represents a physiological adaptation to warm to tropical climates in which the problem of maintaining thermal body equilibrium is one of enhancing the ability for heat loss. The relevant adaptation, one among many, is development of a "skinny" somatype, one which tends to maximize skin-surface to body-mass. This provides a larger proportionate area for heat loss through sweating.

This somatype is visible in accentuated form among some of the desert Caucasoids and Hamites (Caucasoid-Negroid crosses), but it is also characteristic of some Negroid peoples. It presupposes a tendency toward a narrower pelvis, hence a smaller pelvic brim, hence a greater risk of destruction or deformation at birth of the foetuses with very large crania.

However, any sweeping dogmatic judgments on this subject should be tempered by consideration of the fact that the relevant criteria would be both the environmental challenges which have originally shaped different ethnic taxa and their subsequent readaptation and change with changes in their habitat. Thus, as we have seen, some of the Negroid peoples of the temperate zones of Africa who are also meat eaters, in particular the Amaxosa, are unusually large-brained. In the Mongoloid race, there seems to be a tendency for cranial size to reach maxima

¹³ A primitive Negrito people of Sri Lanka (Ceylon).

among peoples who have remained in extremely cold climates and hence have continued to adapt to the same challenge of heat conservation, such as Buriats, Torguts, Fuegians and Eskimos. Mongoloids who have moved into southern and south-eastern Asia and have lived their for centuries tend to be somewhat smaller brained.

The relationships between pelvic brim, cranial size and intelligence among peoples and ethnic groups need a great deal more empirical investigation before we can judge whether or not these or other hypothesized relationships are valid.

The Intelligence of the Chinese and Malays in Singapore

By RICHARD LYNN*

In the comparatively few studies of the intelligence of Mongoloid peoples it has generally been found that they obtain approximately the same mean I.Q. as the Caucasian peoples of Europe or of European origin. In the United States the largest study is the Coleman Report (Coleman, 1966). This gives the test results of a study of some half a million American children and it was found that Mongoloid children, in contrast to Negroes and American-Indians, obtained approximately the same mean I.Q. as Caucasians. In Taiwan, Chinese children have virtually the same mean I.Q. as American and British children on Cattell's culture fair test (Rodd, 1958). In Hawaii a well drawn sample of ten-year-old Japanese children on the island of Kauai were found to have a mean I.Q. of 108 on the American Primary Mental Abilities Test (Werner *et al.*, 1968). In Japan it has been estimated that the population has a mean I.Q. of 106.6 relative to the United States mean of 100 (Lynn, 1977). Thus the evidence is beginning to mount up to indicate that Mongoloid peoples have a mean I.Q. which is at least as high as European and American Caucasians and possibly higher.

The present paper presents some further results on this question from Singapore. The data is taken from S. L. Phua's (1976) unpublished Ph.D. thesis from the University of Alberta. The thesis was designed to provide information on the intelligence level in Singapore, especially with respect to any differences that might be present between Chinese and Malays. For this purpose the author took as her sample 13-year-old boys from four representative secondary schools in Singapore. The total number of boys tested was 337. The sample is perhaps a little small, but was apparently carefully selected to be representative of the population and was evidently accepted as such by the examiners for the Ph.D. degree at the University of Alberta.

The principal intelligence test used was Raven's Progressive Matrices, a well-known test originally designed and standardised in Britain in 1939-40. The test results are presented as percentiles rather than I.Q.s, but these percentiles are easily transformed into I.Q.s based on the usual mean of 100 and SD of 15.

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