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# The Palaeo-Biological Evidence for Admixture between Populations in the Southern Levant and Egypt in the Fourth to Third Millennium BCE

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The shifting boundaries between sub-Saharan African, Asian and European flora and fauna, as well as human cultures, document the role played by the Nile Valley as a major route for biological and cultural contact between Asia and Africa throughout the past (van Peer 1998). Until the late Pleistocene, climate was one of the main factors affecting the distribution, spread and viability of flora and fauna, as well as humans. However, the human factor—expressed in the archaeological record by cultural and technological innovations—subsequently came to play an ever-increasing role in modifying the direction, strength and extent of change through trade and warfare.

In the Neolithic period, there are many similarities in flint artifacts, burial patterns and other aspects of material culture between North Africa, the Nile Valley and the southern Levant (Alexander 1984; A. Smith 1996; Wenke 1991), while the advent of plant and animal domestication in Egypt appears to owe much to the Levant. Many of the earliest domestic plants and animals exploited in Egypt, with the possible exception of cattle (Wendorf and Schild 1984), appear to have been introduced into the region either directly from the Levant or via coastal North Africa. Although there is no direct evidence to suggest that this process was accompanied by large-scale population movements (Hassan 1985, 1988; A. Smith 1996; Wenke and Brewer 1992; Wenke *et al.* 1988; Wetterstrom 1996), there is good evidence for intensive contacts between the southern Levant and the Nile Delta in the Late Predynastic Period (Faltings 1998; Levy 1992, 1995; Rizkana and Seeher 1990; chapters in this volume). At Maadi, settlement patterns, material culture and burial patterns in one section of the site show an especially close resemblance to those of Chalcolithic sites in the Beersheva region, Israel (Fig. 6.1). So much so that Tutundzik (1997) proposed that an entire section of Maadi might have served as living quarters of traders or merchants from southern Israel. Additional parallels between specific sites in the two regions in this period have been described by Faltings (1998). She reported that at Buto the pottery possibly originates from the same source as that found at Nahal Mishmar, in the Judean Desert.

In the Early Dynastic period, the complexity and wealth of societies in the two regions differs markedly and

although imports from the Levant continue to enter Egypt, the direction of influence is reversed. Early Bronze Age sites in Israel show a strong Egyptian component variously attributed to trade, conquest or ethnic migration (Beit Arieh 1984; Gophna 1996; Joffe 1991; Kempinski and Gilead 1991). The Egyptian influence does not however seem to have extended to burial practices. Only one Egyptian-style tomb is known from this period in Israel. This is the Early Bronze Age tomb at Nahal Tillah, but even here the similarities do not extend to the tomb contents (Levy *et al.* 1997). The extent to which the changing spheres of influence demonstrated by the archaeological record were associated with movement of populations between the two areas has been a major theme of bio-anthropological research in the region. Current research into these issues, integrating data on the molecular biology of modern populations with new data on skeletal remains from the Nile Delta and southern Levant is discussed here.

## Egyptians today

The biological characteristics of modern Egyptians show a north-south cline, reflecting their geographic location between sub-Saharan Africa and the Levant. This is expressed in DNA, blood groups, serum proteins and genetic disorders (Filon 1996; Hammer *et al.* 1998; Krings *et al.* 1999). They are also expressed in phenotypic characteristics that can be identified in the teeth and bones (Crichton 1966; Froment 1992; Keita 1996). These characteristics include head form, facial and nasal characteristics, jaw relationships, tooth size, morphology, and upper/lower limb proportions. In all these features, modern Egyptians resemble sub-Saharan Africans (Howells 1989, Keita 1995).

On the assumption that in the past, as in the present, most marriages were contracted between people living in the same or adjacent areas, a north-south cline in gene frequencies along the Nile Valley is to be expected. It correlates well with the geographic distance between settlements in the extreme north and south of Egypt as well as to their proximity, at one end of the country, to sub-

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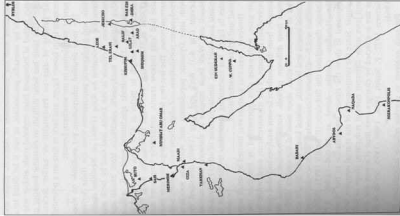


Figure 6.1 Map showing sites in Egypt and the southern Levant referred to in text.

Note: Nahal Tibnah is adjacent to Tel Halif.

Skeletal characteristics considered indicative of a sub-Saharan African affinity include narrow heads and short broad faces, with broad flatfish noses and long limbs relative to trunk length. Furthermore, the tibia is long relative to femur length. Froment (1992) reported that cranial characteristics of past Egyptians were intermediate between those of other African populations and Europeans. Skeletal characteristics of Europeans and the southern Levant include long forward-projecting faces and long, narrow projecting noses (Howells 1989). The limb proportions also differ with limb length in Europeans shorter than that of Africans relative to trunk length, while the tibia is shorter relative to the femur (Krogman 1962). The differences found between modern-day people in the two regions appear to reflect long-term adaptive changes to climate and altitude, and specifically to humidity and temperature (Crogner 1981, Hlermaux and Froment 1976). The maintenance and/or intensification of these differences is dependent on the extent of gene flow between the two regions.

### Egyptians in the past

Publications on skeletal remains of ancient Egyptians date back more than a hundred years (Warren 1897). Consequently, the different approaches and concepts discussed in the literature reflect the history and development of bio-anthropology as a scientific discipline, incorporating research on growth and development, adaptation, evolutionary genetics and epideimology. The hypothesis that migration into the Nile Valley from the Mediterranean littoral played a major role in the development of Dynastic society in Lower Egypt dates back to the earliest days of Egyptian exploration (Elliot Smith and Wood Jones 1910; Morant 1925; Petrie 1920; Warren 1897). This hypothesis stemmed from early studies of skeletal remains from Predynastic and Dynastic sites, predominately from Middle and Upper Egypt (Elliot Smith and Wood Jones 1910) as well as from the site of Turah, south of Cairo (Derry 1912). Elliot Smith reported finding differences between Dynastic and Predynastic skeletal remains. However, his interpretation of these findings was formed by his reliance on concepts of 'racial' types prevalent at that time. More recent studies have, however, confirmed that there were significant phenotypic differences between Early Dynastic populations in Upper and Lower Egypt (Hillson 1978; Keita 1988, 1992, 1995, 1996). The timing and origin of these differences still needs to be determined. The most parsimonious explanation is that they reflect long-term differentiation between small groups operating in different environments within Egypt, as postulated by Hassan (1988) and Debono and Mortensen (1990). Alternatively, the differences may have resulted from the arrival of a distinct ethnic group, either in the Neolithic—associated with the introduction of domestic plants and animals by nomadic pastoralists—or in a later period when inter-regional trade became important.

For Upper Egypt and Nubia, there is good archaeological and bio-anthropological evidence for population continuity from the Mesolithic to recent times. The diachronic changes reported for Nubians conform to those predicted for micro-evolutionary change *in situ* (Carlson and van

Saharan Africa and, at the other, to the Mediterranean coast. However, this may not be the only explanation for the differences observed. There is good evidence from historical periods of large-scale incursions of foreign armies and colonists into Egypt. Those from Europe and Asia included Semites, Greeks, Romans, Arabs, Kurds and Turks who mainly settled in the north, while the south was especially influenced by incursions from Sudan (Waterson 1998). Gene flow along the Nile would then have fluctuated with the extent of contacts and ease of movement between settlements. Mitochondrial DNA analyses support the hypothesis that migration from north to south was either earlier or less important than migrations in the reverse direction (Kriings *et al.* 1999). They do not however explain the origin of differences between the people of Upper and Lower Egypt in earlier periods.

Gervén 1977; Nielson 1970). Morphometric characteristics of samples from all periods are significantly different to those of their near contemporaries in the Levant and North Africa (Hershkovitz 1981; Hershkovitz *et al.* 1987; P. Smith 1979, 1988). This despite the fact that in all three regions a significant amount of micro-evolutionary change occurred throughout the Holocene (Carlson and van Gerven 1977; P. Smith 1988). In all three regions cranial size decreases and facial proportions change. The teeth and jaws reduce in size, and the jaws become narrower anteriorly. The face becomes longer and narrower.

Elliott Smith and Wood Jones (1910) and Derry (1912) reported that Predynastic populations from Middle and Upper Egypt were short, with small heads, short faces and flat noses, and differed from the later Dynastic populations. First identified at Giza, these were described as taller than Predynastic Egyptians, with larger heads, longer faces and more projecting noses. Elliott Smith and Wood Jones (1910) hypothesized that the Predynastic populations were indigenous, while those first identified at Giza had entered Lower Egypt from the Mediterranean littoral, from east and/or west of the Nile Delta. According to Elliott Smith and Wood Jones (1910) these people later spread south and played a major role in the unification of Egypt.

Morant (1925) and Batrawi (1946) also found significant differences between Predynastic Upper Egyptians, represented by Naqada, and those from Lower Egypt, represented by Giza. Subsequent investigations, using different sets of variables and more sophisticated statistical analyses, have confirmed that marked differences existed between Predynastic and Early Dynastic samples from the north and south of Egypt, and that these differences decreased in later periods (Crchillon 1966; Hillson 1978; Keltia 1992, 1995, 1996). These studies were largely derived from the same sites as those used by earlier researchers, such as Badari, Giza, Naqada and Sediment, and include little or no data on Predynastic sites in Lower Egypt. A brief assessment of Predynastic and Early Dynastic material from the site of Turah south of Cairo was published by Derry (1912). He stated that the Predynastic specimens from this site resembled those identified from Predynastic sites in Upper Egypt, with small narrow crania, short faces and wide flat noses. Specimens from the same site attributed by him to the Third Dynasty conformed to the so-called Giza type, and were characterized by more 'European' features. The majority of studies carried out on regional and chronological variation within Egypt then corroborate the existence of differences between people in Upper and Lower Egypt in the Early Predynastic and Dynastic periods. However, they have not demonstrated the source of these differences. They suffer from lack of attention to the possible confounding effects of secular trends that are reversible versus the impact of long-term micro-evolutionary trends on size and shape. Thus Keltia (1992) found that distance between populations from Badari, Naqada and Abydos, as calculated from metric parameters, correlated well with chronology rather than geographical distance.

The differences reported between skeletal samples from Upper and Lower Egypt may reflect long-term differentiation between small, isolated and geographically distinct groups within Egypt, rather than the sudden arrival of a distinct ethnic group. If the latter occurred, was it

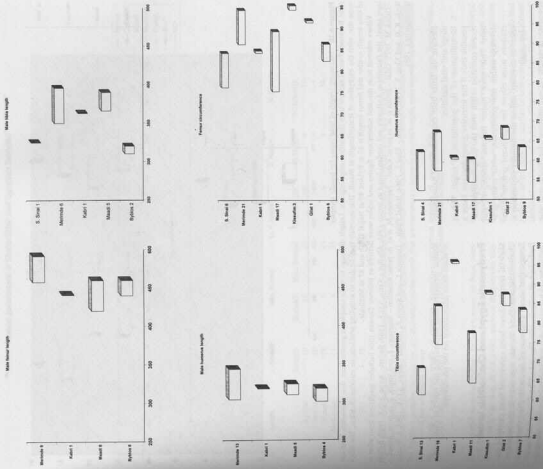
associated with the introduction of domestic plants and animals by nomadic pastoralists, or can it be dated to a later period of increased inter-regional trade and/or warfare? This issue has been difficult to examine because of the paucity of data on Predynastic or earlier skeletal remains from Lower Egypt, and lack of data on a potential 'parent' population in the southern Levant.

The most detailed information yet available on Neolithic and Predynastic populations from the Delta derives from the publication by Klug (1984) on Neolithic specimens from Merimde in the Delta, and that by Beck and Klug (1990) on Predynastic specimens from Maadi and Wadi Digha. The Merimde specimens were tall, with a mean femur length in males of 47.1 cms, compared to 43.6cm at Maadi and 44.7cm at Byblos (Fig. 6.2). They also had long narrow crania, moderately long faces and narrow noses. The last two features distinguish them from Predynastic populations and align them more closely both with later Dynastic populations and with the southern Levant (Fig. 6.3). Beck and Klug (1990) described the Maadi and Wadi Digha samples as showing long narrow crania and short faces, similar to those of other Predynastic sites in Egypt, but resembling some sites in the Levant in nasal and orbital characteristics.

However, even this analysis was limited by small sample sizes, with some sites represented by less than four individuals for some of the measurements used, while the samples from the southern Levant analyses included specimens from different periods. Such procedures entail the risk of misclassification, since most of the criteria used—cranial length and breadth, orbital form, facial height and midface width—all show characteristic micro-evolutionary change throughout the Holocene (P. Smith 1995), indeed the Natufian sample, dated at 10,000–12,000 B.P., appeared to show the closest resemblance to the Maadi sample. Since the components of the cranial complex, face and jaws show different rates of reduction, shape as well as size is affected by changes over time (Carlson and van Gerven 1977; P. Smith 1988, 1989, 1995; Smith *et al.* 1984).

For such analyses to provide reliable information on the timing and extent of past population movements between regions, the following criteria must be met:

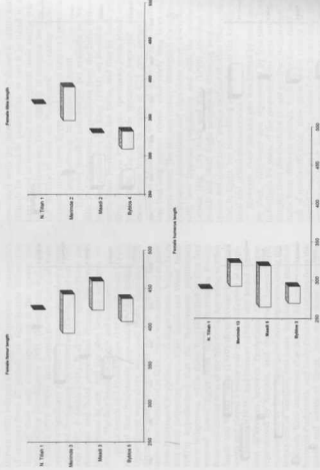
1. Adequate, well-dated samples for statistical analysis. For these to be considered representative of the population in a specific location they should be of comparable age and sex and from different tombs. This since both age and sex affect morphometric values, while individuals from the same or adjacent tombs may represent one lineage rather than the population at large.
2. Presence of significant change in the presumed intrusive group from that of previous and adjacent groups in the region. The change should be outside the range and direction of the differences expected resulting from long-term selective pressures (i.e. micro-evolutionary change), or from short-term environmental pressures affecting growth development and muscle function in individuals. The former may be inferred from the archaeological and osteological findings regarding adaptations and



**Figure 6.2a** Maximum length and midshaft circumference of long bones for male samples

Note: Bars represent mean values,  $\pm 1$  SD. Note the low values for tibia length at Byblus, relative to femur length. Mean femur length at Byblus exceeds that of Maadi, but tibia length is less. Limb bone proportions in the one Early Bronze male from Kabri are similar to those of Byblus, with tibia length shorter relative to femur length than in the Egyptian samples. Note also the trend for more slender limb bones, relative to length of the Egyptian sample.

At some sites maximum length could not be measured because the bones were too fragmented.



**Figure 6.2b** Maximum length of long bones for female samples  
 Note: Because of small sample sizes the entire range is given. Length of bones in male samples is greater than that of females from the same site, with the exception of femur length at Maadi. This anomaly may be due to sampling problems or misidentification. The ratios of tibia length to tibia and femur length is 45 at Byblos; 45 at Nahal Tillah and 47 at Merimde.

Values referred to in this and subsequent figures and tables were derived as follows: Caraan (this includes specimens from what is now Israel, the Palestinian Authority and Jordan) listed in Smith 1995; Ahiyón - Kella, S.O.Y. 1988; Badari - Kella, S.O.Y. 1988; Byblos - Ozbeck M. 1975; Gilat - Smith *et al.* in press; Kabri - Faerman M. *et al.* in press; Kissufim - Zagerson, T. and Smith, P. in press; Maadi - Breck, K. G. and Klug, S. 1990; Merimde - Klug S. 1984; Nahal Tillah - Dawson L. and Smith P.; Napáda - Kella, S.O.Y. 1988; S. Sina - Hershkowitz L. 1981

lifestyle; the latter from examination of palaeopathology and vital statistics.

3. Identification of the population of origin. This is possible only if the intrusive group does not share a recent common origin with the indigenous population. This since major cultural differences can develop within one generation, while many generations must elapse for significant genetic differences to develop, unless the founder population is very small.

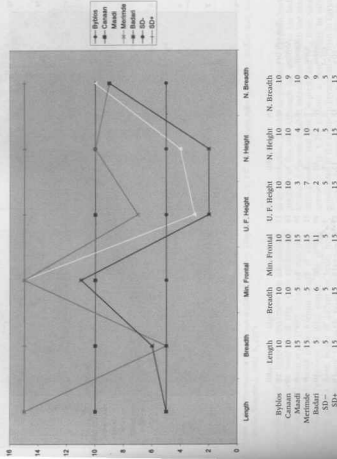
The data presently at our disposal for Egypt and the southern Levant do not fulfil all these criteria, but do represent a major advance on that available to earlier researchers. Most importantly, there are now data available on skeletal remains from the Predynastic and Early Dynastic sites in the Delta, and Chalcolithic and EB sites in the Beer Sheva region, which show the greatest similarity in archaeological complexes. The sample sizes are small, but permit us to compare broadly contemporary groups with

similar lifestyles, thus minimizing the effect of chronology or short-term adaptations on the phenotype.

### Predynastic Egypt and Chalcolithic Israel

Skeletal remains have been recovered from many of the Chalcolithic and Early Bronze Age sites in the southern Levant that show evidence of ties with Predynastic and Early Dynastic Egypt (see Fig. 6.1). The Chalcolithic sample discussed here includes specimens from Ben Shimon, Kissufim, Nahal Mishmar and Wadi Makkukh, Shiloqim, Gilat and Horvat Hor described in P. Smith (1995), Levy (1992), Sabari and Smith (1993) and Zagerson and Smith (in press). The Early Bronze Age sample studied here includes Nahal Tillah, Tel Eram, proto-Urban Axor, Jericho and Bab edh Dra (Arensburg 1973; Dawson and Smith in press; Kurth and Rohrer-Ertl 1981; P. Smith 1989, 1995). The similarities in settlement patterns, architecture, burial

## Cranial parameters of Chalcolithic and Egyptian Samples



**Figure 6.3a** Comparison of cranial measurements in males from Late Neolithic and Predynastic sites in Egypt and Chalcolithic sites in the southern Levant (Canaan and Byblos).

Note: Byblos here is used as the standard. Note that all values for the series from Canaan show a close resemblance to those of Byblos. The Egyptian samples, in contrast, are characterized by crania that are narrower relative to cranial length, with shorter but broader faces than those of the southern Levant.

Key: Length = maximum length of cranium; Breadth = maximum breadth of cranium; Min. Frontal = minimum frontal width; U.F. Height = upper facial height; N. Height = nasal height; N. Breadth = nasal breadth

patterns and material culture between some of these sites and those in the Delta have been described elsewhere (Levy 1995; van den Brink 1992; various chapters in this volume).

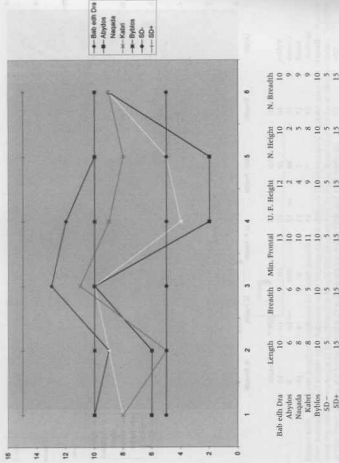
Unfortunately, most of the skeletal remains were in poor condition when found, and many bones fragmented when removed from the ground. This limited the number of specimens that could be reliably measured. At Gilat, primary interment in flexed position without grave goods was the norm. At Shiqmim, primary and secondary burials were found in the cemetery and village (Levy 1995; Levy *et al.* 1991). At Ben Shimon (Perrot and Ladry 1980), and Kissufim (Zageron and Smith in press) skeletal remains were found in secondary contexts, mainly in ceramic and stone ossuaries. Secondary burial was also practiced at Nahal Mikhmar where the bones were found

in baskets and mats (Bar-Adon 1980). The skeletal remains from Horvat Hor had been buried in a cave and sealed off by a wall constructed of undressed stones (Guvrin 1987).

The skeletal remains from the Negev, coastal plain and Judean desert sites are similar to one another, and almost identical to those of Byblos (Figs 6.2, 6.3a). They were of short to moderate stature with slender bones, but areas of muscle attachment, especially the deltoid tuberosity in the upper arm, were well pronounced. The crania were small and characterized by dolichocephalic skulls, moderately long, broad faces and long narrow noses with short, broad jaws (Fig. 6.3c). Cranial and facial measurements, shown in Figure 6.3, closely resemble those of the Chalcolithic skeletal remains from Byblos studied by Ozbek (1975). The same characteristics are present in the Early Bronze



## Cranial Parameters of Early Bronze and Egyptian Samples



**Figure 6.3b** Comparison of cranial measurements in males from Predynastic and Early Dynastic sites in Egypt and Chalcolithic and Early Bronze Age sites in the southern Levant (Canaan and Byblos)

Note: Byblos here is used as the standard. Note that all values for the series from Canaan show a close resemblance to those of Byblos. In contrast, all Egyptian samples differ, retaining the shorter face and nasal height of the earlier Egyptian crania referred to in Figure 6.3a.

Age samples from Bab edh-Dra, Kabri and Azad (P. Smith 1995). The Proto-Urban, predominantly Early Bronze Age samples reported from Jericho (Kurth and Röhrer-Ertl 1981) and Azor (Arensburg 1973) include some individuals with slightly broader heads and faces but fall within the range of population variation of other Chalcolithic and Early Bronze Age populations in the southern Levant (P. Smith 1989, 1995). Ben-Tor (1973: 9) referred to a personal communication suggesting the presence of Africans among the skeletal remains from Azor. However Arensburg (1973), who studied the skeletal remains, concluded that this was not so (1973: 90). He reported that the Azor population could be traced back to earlier Natufian and Neolithic populations in the southern Levant.

Figure 6.3 illustrates some of the cranial parameters of Egyptian, Chalcolithic and Early Bronze Age skeletal samples. Mean values and standard deviations of all measurements for Byblos and other Chalcolithic sites in the southern Levant overlap, while those from the Egyptian

Predynastic and Early Dynastic sites diverge considerably. The small and incomplete data set (not all measurements could be made on all specimens) indicates that the values quoted may not accurately reflect the entire range of population variation at any one site. However, the data sets available demonstrate consistent differences between samples from the Levant and those from Egypt. This is manifest in cranial breadth, upper facial height and nasal height.

Limb length proportions in males from Maadi and Merimde group them with African rather than European populations. Mean femur length in males from Maadi was similar to that recorded at Byblos and the Early Bronze Age male from Kabri, but mean tibia length in Maadi males was 6.9cm longer than that at Byblos. At Merimde both bones were longer than at the other sites shown, but again, the tibia was longer proportionate to femurs than at Byblos (Fig. 6.2), reinforcing the impression of an African rather than a Levantine affinity. The mid-length

