

Malformed skulls from criminal Anthropology: a preliminary study on the *Cranioteca* of the Anthropology Museum of Naples

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Abstract. The Anthropology Museum of the University of Naples Federico II has a prestigious heritage illustrating human evolution and biodiversity. The Osteological Collections, including Nicolucci's *Cranioteca*, represent a consistent biological archive. Constituted of more than 2000 human skulls, collected among late nineteenth and early twentieth century, the *Cranioteca* includes numerous specimens affected by malformations, trauma and diseases that document the presence in past populations of pathologies that still afflict humanity. Among these, some skulls with craniosynostosis and facial dysmorphisms are of particular interest. The aim of this work is to present the studies carried out at the end of nineteenth century on the malformed skulls of Nicolucci's *Cranioteca* comparing them with the modern knowledge on craniosynostosis and facial dysmorphisms to show how new research approaches could reveal additional scientific information hidden in these ancient finds.

Key words: malformed skulls, craniosynostosis, human remains, Anthropology Museum of Naples

Introduction

Osteological, Archaeological and Ethnographic Collections of Anthropology Museums are a valuable cultural heritage allowing to illustrate evolution and human biodiversity and represent an important source of study. One of the first anthropological institutions arose in Europe was the Anthropology Museum of Naples, belonging to the Museum Centre of Natural and Physical Science. Found in 1881 by Francesco De Sanctis, the Kingdom of Italy's Education Minister, its heritage consists of over 26,000 exhibits made up of specimens especially of the Giustiniano Nicolucci's research, the Museum's first Director and eminent anthropologist.

Among the Osteological Collections, the prestigious Nicolucci's *Cranioteca* is an extraordinary biological archive. Realized with the intention to

create an anatomical Museum like others existing in Italy, the *Cranioteca* contains more than 2000 specimens resulting not only from the Nicolucci's private Collection but also from the acquisitions of the Museum's subsequent Directors. The Collection, created between the late nineteenth and early twentieth century, mainly testifies the researchers' attention toward the skull as the seat that best characterized human physical attributes and allowed the classification of men in "types", as described in the preface of *Delle Razze Umane* by Nicolucci (1). The *Cranioteca* also includes numerous specimens suffering from malformations, trauma and infectious, metabolic, congenital and neoplastic diseases. These finds document the presence in past populations of pathologies that still afflict humanity. Among the pathological skulls are also those of Zuccarelli's Collection belonging to the Institute of Criminal

Anthropology, later on acquired by the Anthropology Museum (2).

Most of the human skulls of the Neapolitan Museum were studied mainly by Abele De Blasio (Figure. 1), doctor and pupil of Nicolucci, an eclectic and multifaceted figure who curated the Anthropology Museum. He enriched the Museum's heritage not only by the acquisition of human skulls but also through the donation of archaeological artefacts derived from his Collection. Lecturer in anthropological disciplines at the University of Naples, De Blasio was also in charge of the Anthropometric Office at the Royal Police Station in Naples where he assisted the Scientific Police in the investigation of the Neapolitan underworld. De Blasio, born in 1858 in Guardia Sanframondi (Benevento), deepened the study of skulls suffering from malformations considering them indicators of mental illness or atypical behaviours. De Blasio's studies resulted in a vast production of more than 215 historical and scientific papers many of which were written to contribute

to the criminal Anthropology of South Italy (3, 4). According to the criteria of the positive Anthropological school, he regarded the abnormal as madhouse people or delinquents. He subjected them to anthropometric observations to identify the physical differences with normal people and to trace in the body asymmetry the imprint of moral degeneration establishing the biological inferiority of the "different" (5, 6). His fame was also known to Cesare Lombroso, father of criminal Anthropology, who defined him as the main scholar of the camorra, brigandage and delinquency, believing that many have attempted to study the terrible problem of the camorra but that no one has been able to penetrate its intimate customs (7, 8). Lombroso argued with the "born delinquent" theory that a high percentage of the most serious and persistent criminals would have a congenital predisposition of a hereditary nature. In agreement with Lombroso's theories, De Blasio considered that the "born criminals" were characterized by particular anatomical, physiological and psychological features such as facial asymmetry, low forehead and protruding cheekbones (Figure. 2).



ABELE DE BLASIO

Figure. 1 Abele De Blasio (Guardia Sanframondi 1858- Napoli 1945)

The malformed skulls of the Anthropology Museum: the rediscovery of collection

The Craniological Collection of the Anthropology Museum tells inevitably of its time, the motivations and the criteria by which it was formed: next to a historical interpretation it is now important to rethink and re-propose this ancient Collection according to a modern vision so that it can be fully enjoyed by researchers and the public. Since most of the skulls are kept in the deposits the Collection has been subjected to a careful recognition which allowed us to identify and rediscover about fifty skulls with evident malformations. These specimens are mostly affected by macrocephaly, microcephaly, plagiocephaly and scaphocephaly, for which it is certainly interesting to compare the information emerging from De Blasio's publications with modern knowledge related to some anomalies of the cranial development, such as craniosynostosis and facial dysmorphisms.

The skull of Maria D., died at the age of 52 at the Incurables Hospital of Naples, is very emblematic.

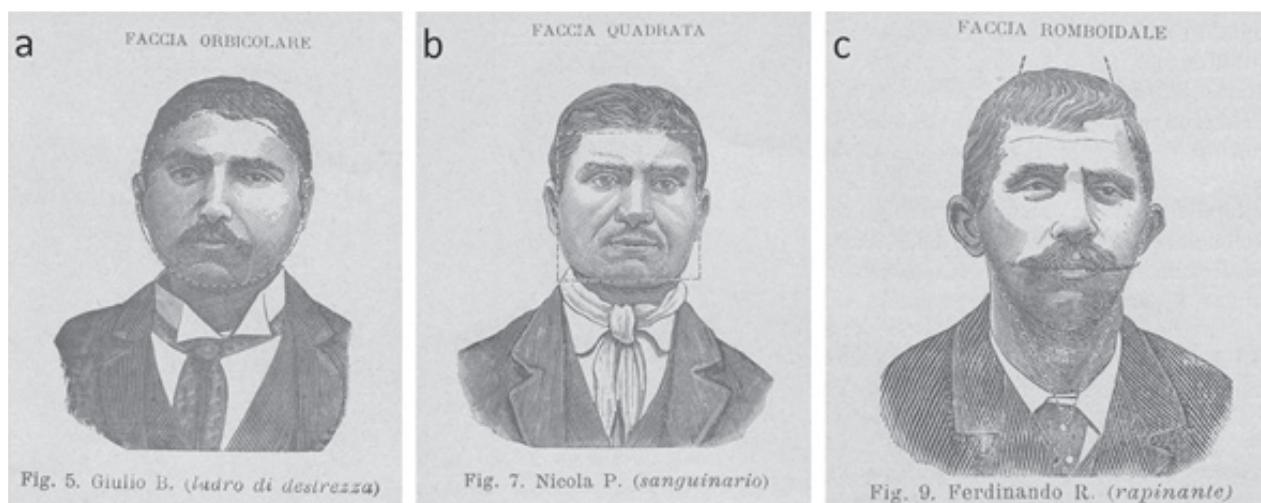


Figure. 2 Face shapes drawings of Neapolitan delinquents - a) orbicular face, dexterity thief; b) square face, bloody; c) rhomboid face, robber. From “Delitti e forme geometriche della faccia fra i delinquenti napoletani (4)

Recorded on 17.01.1901 in Register II of the annual Inventory with indication of origin from the Neapolitan territory, it is described as megalcephalic by De Blasio in “*Cranio piramoide in un’epilettica*” (Figure. 3) (9). The skull with cubic capacity of about 1600 is highly developed in a vertical and transverse-basilar direction such as to take the shape of a pyramid trunk. De Blasio anthropological observation revealed that the forehead is flat, eyebrows and glabella are absent, the nasal bones are shaped like donkey’s back (Figure. 4a). The temporal and sagittal sutures are completely closed and the occipital foramen has a rhomboid shape with irregular and serrated edges (Figure. 4b). The bones are very thin and semi-transparent and the diploe almost disappeared (Figure. 4a). De Blasio also reports that the woman was affected by epilepsy and correlates this disease to the abnormal development of the skull during intrauterine life. The woman was nicknamed “the witch” by the inhabitants of Pendino quarter, for the triangular head, the ears that appeared detached from the skull, the bulging eyes and the epileptic seizures of which she suffered.

Another interesting case is the Menica’s skull described by De Blasio in 1903 (10). Identified with the catalogue number MA6643, only the skullcap remains. Menica was a woman affected by macrocephaly

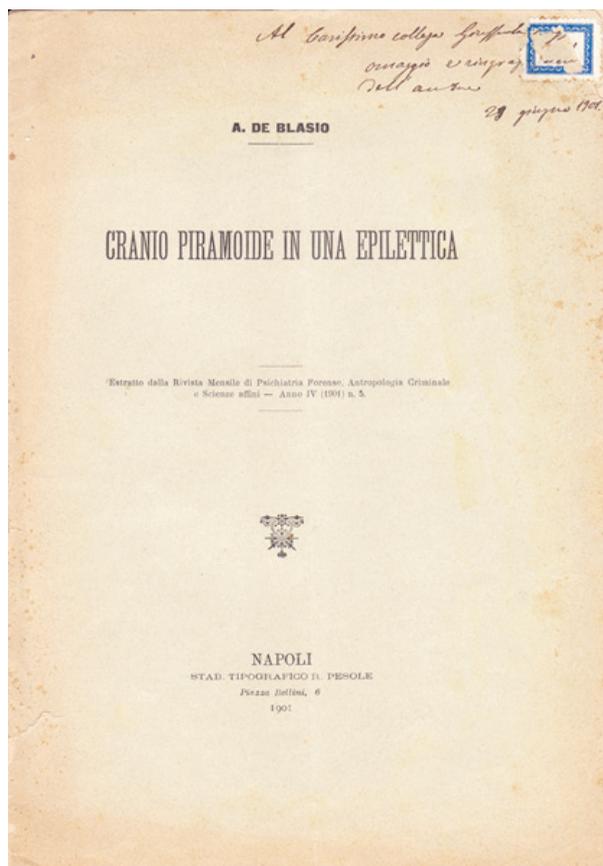


Figure. 3 Cover of “Cranio piramoide in una epilettica” by A. De Blasio (7)



Figure. 4 Piramoid skull - a) frontal view; b) posterior view; c) cranial base showing pervasive palate porosity and sphenoid bone destructive lesion (à); d) detail of the left orbit with presence of cribra orbitalia. The bar is 5 cm.

(Figure. 5a) derived from hydrocephaly, died at the age of 72, extraordinary longevity for an individual with such a malformation. De Blasio reports that she developed macrocephaly after birth, at the age of 2 and a half years. Due to the great cranial capacity (3500), she had the head tilted on her chest so the chin region was worn out for the continuous friction and she was unable to perform complex and coordinated movements. Observed from the posterior norm, the Menica's skull presents, near the lamboid suture, supernumerary

Wormian bones that are often associated with a rapid skull expansion (Figure. 5b) (11, 12, 13).

Notable is also the microcephalic skull MA6638 belonged to Zuccarelli's Collection donated in 1950 to the Anthropology Museum's Director Mario Galgano (2). This specimen, of which remains only the skullcap, presents on the frontal bone a writing in pencil that describes it as "microcephal". In fact, its cranial circumference is equal to 43,5 cm, a very low value than a normal skull (55-58 cm) (Figure. 6a,b).

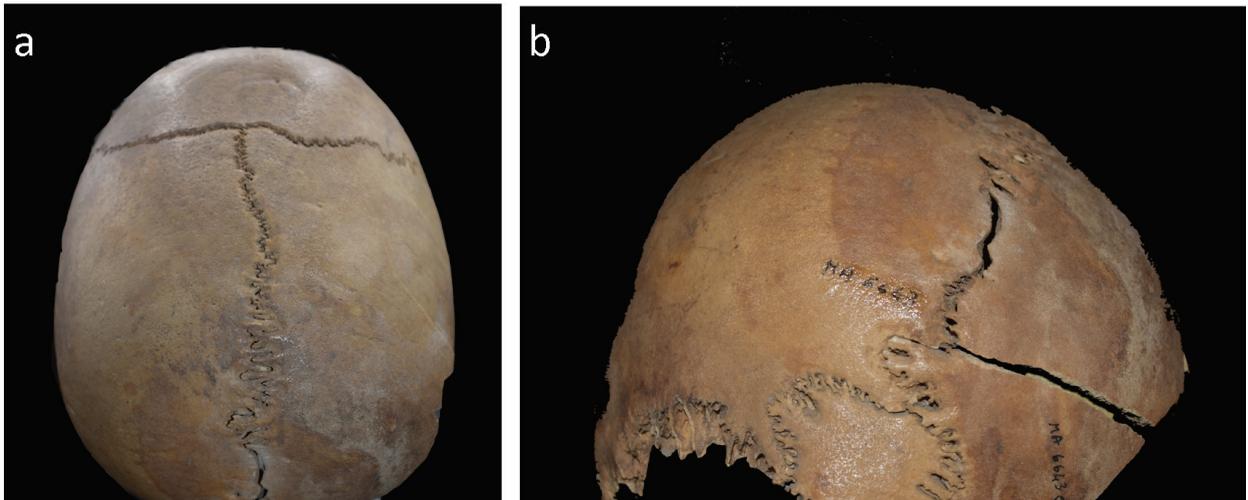


Figure. 5 Macrocephalic skull – a) cranial vault; b) transverse posterior vision, note supernumerary Wormian bones (à) near the lamboid suture. The bar is 5 cm.

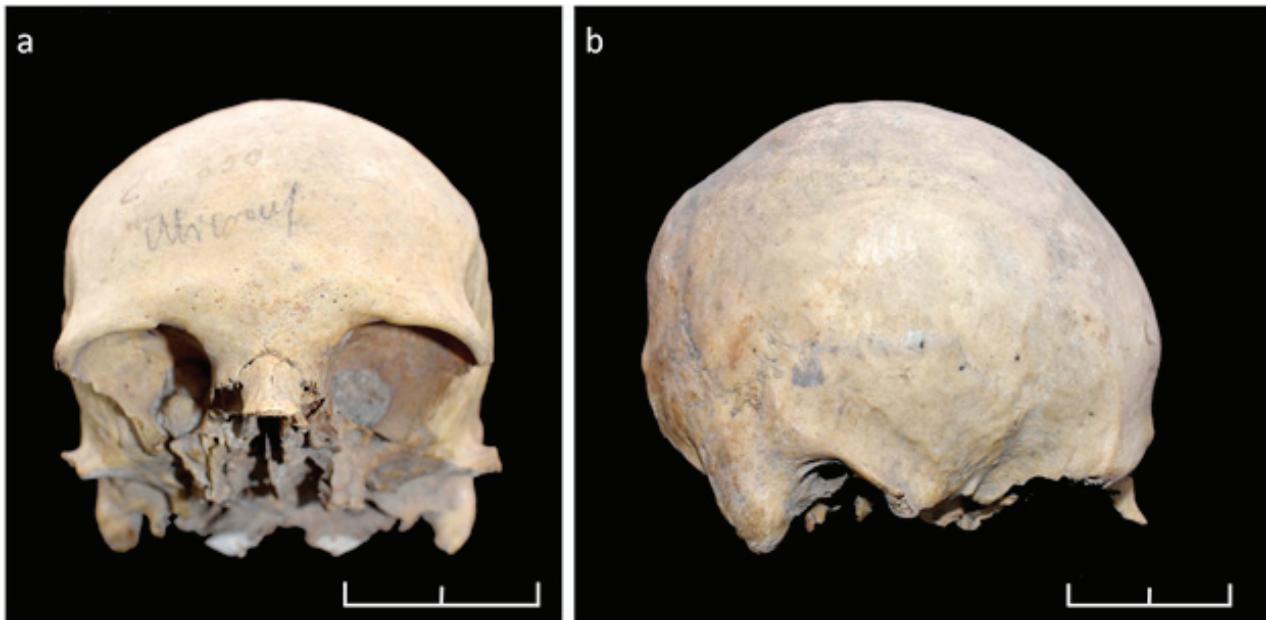


Figure. 6 Microcephalic skull - a) frontal view; b) lateral view. The bar is 5 cm.

From the first century of the Christian Era is the plagiocephalic skull (MA6636) found in the San Gennaro Catacombs in Naples. From the sexual characteristics De Blasio considers it belongs to a man of about 60 years. The skull is asymmetrical due to the obliquity of the main axis, resulting from the early welding, on one side, of the front and parietal bones (Figure. 7a). It is characterized by triangular orbits

with an oblique implant and the skullcap, in the shape of an ellipse, seems to have carried out a twisting movement (Figure. 7a,b). These anomalies, as described by De Blasio, are due to the early welding of half of the left coronal suture, of the posterior part of the sagittal suture and of the left half of the occipito-parietal (Figure. 7b,c). So, the brain was forced to expand where the sutures were not fused (10).

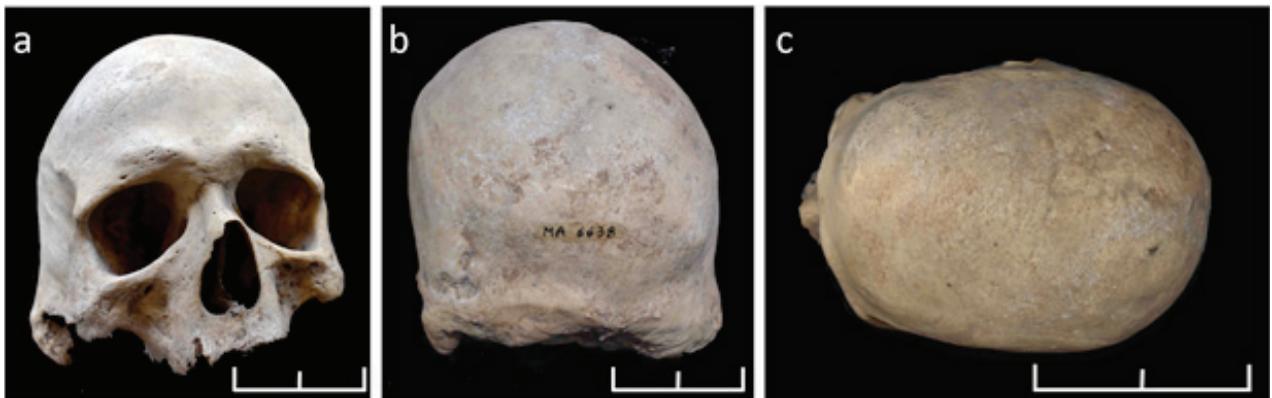


Figure. 7 Plagiocephalic skull - a) frontal view; b) posterior view, c) cranial vault. The bar is 5 cm.

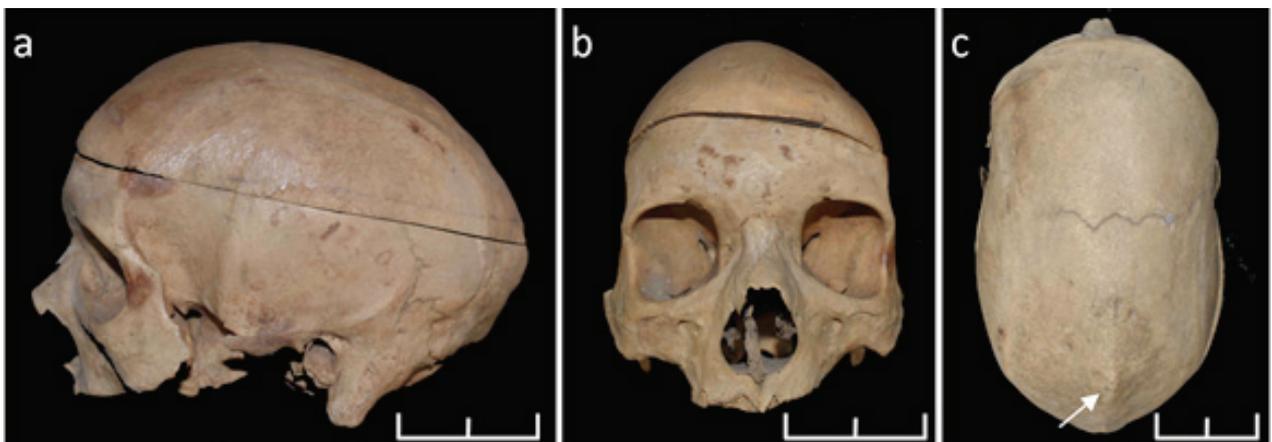


Figure. 8 Scaphoid skull - a) lateral view; b) frontal view, c) vertical norm, note the protrusion of the occipital region (à). The bar is 5 cm.

Interesting is also the scaphoid skull (MA6651) buried in 1567 in the 3rd section of the AGP cemetery in Naples (14). In “*Cranio scafoide di A.G.P. di Napoli*” (1896), De Blasio reports that the skull belonged to a 70 year old man. He also assumes that the place of birth is difficult to specify because the AGP cemetery kept human remains from different countries. The skull is flattened across its length in transverse direction and elongated in antero-posterior way (Figure. 8a). The forehead is wide at the bottom and gradually shrinks at the top assuming the shape of a pointed arch (Figure. 8b). The midline of skullcap is in relief from the coronal to the lambdoidea suture. The occipital region is very protruding and, observed from the vertical norm, the skull has the shape of an upside-down boat whose keel would be represented by the ridge relief (Figure. 8c).

Malformed Skulls And Modern Knowledge

Following the historical sources study and the morphological analyses carried out on malformed finds brought to light from the deposits emerges the important role that these interesting specimens can play in the reconstruction of the pathologies that have accompanied mankind since ancient time. Innovative biomolecular technologies could provide precious information related to the causes of the observed malformations. In fact, it is known that some anomalies of cranial development, such as craniosynostosis and facial dysmorphism, are caused by mutations in some genes related to the ossification process (15).

In this context, the skull of Maria “the witch” becomes a singular case study. The conformation of the pyramid skull and the premature closure of cranial sutures could be determined by a gene-linked defect in the ossification process probably due to mutations in the genes coding for the fibroblast growth factors receptors (15, 16).

On the other hand, our morphological observations suggest the presence in “Maria” of a further pathology. We have noted some anomalies as destructive lesions on the sphenoid bone, pervasive palate porosity and presence of *cribra orbitalia* (Figure. 4c,d). These data, together with the megacephaly estimated by De Blasio, lead us to speculate that Maria was affected by congenital syphilis a multisystemic infectious disease caused by *Treponema pallidum* and transmitted to the foetus through the placenta (17). The same can be said for the Menica’s macrocephalic skull. About the causes of the onset of macrocephaly from hydrocephalus, De Blasio suggests some hypotheses ranging from syphilis to tuberculosis, to the old age and drunkenness of the father, to violence, to the frights suffered by the mother during pregnancy and at the marriage between kinsmen. Among all these hypotheses it is plausible that Menica was affected by congenital syphilis due to the presence of various signs attributable to this pathology including hydrocephalus (18), alveolar bones absorption and the abnormal teeth implantation described by De Blasio (10) as well as the slight *cribra orbitalia* observed by us.

It is also interesting to investigate the causes of microcephaly, a condition in which the child has a smaller head than normal. This disease may due either to environmental factors as foetal malnutrition or to genetic causes as deletion affecting the short arm of chromosome 5 responsible for Cri du Chat disease or to mutations of some genes as MCPH1, WDR62, CDK5RAP2, CEP152, ASPM, CENPJ, STIL, CEP63 e CEP135 involved during embryonic neurogenesis (15,19,20).

More complex is instead scaphocephaly which can present in isolated or familiar scaphocephaly syndrome type McGillivray, both link to a gene malfunction, TWIST1 and K526E respectively, that determines the premature fusion of the sagittal suture (21, 22).

Conclusion and Study prospects

In this work, starting from a study of historical data, we carried out a preliminary analysis of the Nicolucci’s Collection malformed skulls speculating also about the possible scientific approaches to valorise and to promote the knowledge of this important Anthropological heritage.

Moreover, taking into account the importance of DNA studies in the anthropological field that providing a significant boost to understanding the evolution of the various aspects of human life, we have in progress, in partnership with the University of Roma Tor Vergata, next generation sequencing studies on the above skulls. In this way, it will be possible to ascertain the gene-linked defect of the observed malformations extending also the intentions for which the Collection was initially purchased.

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