

Bone Clones[®]

OSTEOLOGICAL REPRODUCTIONS

Human Female Skull with Down Syndrome BCM-801



Osteological Evaluation Report

Prepared by

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Human Female Skull with Down Syndrome

Product Number:

BCM-801

Known Information:

The skull is from a 66-year-old Hispanic female who had Trisomy 21 (Down syndrome). This information was documented at the time of the individual's death.

Maxwell Museum of Anthropology:

The Maxwell Museum of Anthropology's Laboratory of Human Osteology, at the University of New Mexico, specializes in numerous facets of physical anthropology. The laboratory serves as a repository of human remains and includes prehistoric, historic, documented, and forensic remains.

Established in 1984 by Dr. J. Stanley Rhine, the Maxwell Museum's Documented Skeletal Collection has grown to include 237 individuals (as of July 2005) encompassing both sexes, all ages, and many population groups. The skeletal remains are obtained by donation, either by the individual before death, or by the family of a deceased loved one. Information on the sex, age, population affinity, and cause of death is available for the majority of these individuals, allowing students and visiting researchers to develop and test new techniques and theories.

Since 1995, prospective donors or their families have been asked to provide health and occupational data as well. With this information, researchers are able to examine the skeletal manifestations of particular diseases including degenerative joint and disc diseases, lymphoma, and osteoporosis, as well as the reaction of bone to repetitive motions and trauma. Recent research has included efforts towards the identification of handedness in individuals, determination of body mass from the skeleton, and variation in cranial damage from various projectiles. The importance of the Documented Collection cannot be overstated. No other institution in the American West has as large a collection of human skeletal remains with such extensive demographic data.

Bone Clones is grateful to the Maxwell Museum for allowing us to select specimens for reproduction from their valuable collection and granting us exclusive casting rights to these pieces.

Human, Female, Down Syndrome

Product Number: BCM-801

Specimen Evaluated: Bone Clones® replica

Skeletal Inventory: 1 intact cranium
1 intact mandible

General observations

In general, the molding process has preserved significant details necessary for evaluation. The general shape and configuration of the skull is not within normal limits: there is brachycephaly, the occiput is flat, and there is a markedly deep, narrow palate. The ectocranial morphology of the individual cranial bones is within normal limits. The sutural patterns are of expected configuration. There are no sutural bones (Wormian ossicles). The foramina are of expected configuration. The skull is atraumatic. There are prominent bilateral frontal vascular grooves.

Dentition

There are 11 teeth in the maxillary arcade and 8 teeth in the mandibular arcade.

All teeth have an adult morphology and no deciduous dentition remains.

There are no dental restorations or prostheses.

There is a moderate degree of attrition.

The following maxillary dentition is present: 1.4 [#5], 1.3 [#6], 1.2 [#7], 1.1 [#8], 2.1 [#9], 2.2 [#10], 2.3 [#11], 2.4 [#12], 2.5 [#13], 2.6 [#14], and 2.7 [#15].

The following mandibular dentition is present: 3.8 [#17], 3.5 [#20], 3.2 [#23], 3.1 [#24], 4.1 [#25], 4.2 [#26], 4.3 [#27], 4.4 [#28], and 4.5 [#29].

The atraumatic gomphoses of 1.5 [#4], 3.4 [#21], and 3.3 [#22] are empty and are without signs of healing.

Healed gomphoses: 1.8 [#1], 1.7 [#2], 1.6 [#3], 2.8 [#16], 3.7 [#18], 3.6 [#19], 4.6 [#30], 4.7 [#31], and 4.8 [#32].

Features of Race:

The interocular distance is not prominently widened. The nasal root is somewhat prominent and the nasal angle is acute. The zygomatic bones retreat posteriorly from the plane of the face. The nasal aperture is narrow superiorly and inferiorly. The anterior nasal spine is prominent, and the inferior margin of the nasal aperture has a sharp (nasal) sill. The maxillary dental arcade has a V-shape. There is mild alveolar prognathism. The maxillary incisors have a slight suggestion of shoveling. There is no edge-on-edge incisal bite. There is no post-bregmatic depression. As a consequence of advanced calvarial sutural ossification, suture morphology is difficult to assess; however, there is the suggestion of at least focal complexity.

The totality of features is most in keeping with those of a White individual.

Features of Sex:

There is very slight prominence of the cranial sites for musculofascial attachment including especially:

- the nuchal lines
- the temporal lines
- the supraorbital tori

There is a narrow ascending mandibular ramus. The nasion is smooth, and the supraorbital margins are sharp. The inferior border of the mandible is somewhat V-shaped.

The totality of features is most in keeping with female sex.

Features of Age:

There are no identifiable fontanelles. The spheno-occipital synchondrosis is fused. Ten ectocranial osteologic landmarks are evaluated for degree of suture closure according to the Meindl and Lovejoy method*.[1] Scores are assigned as follows:

1	3
2	3
3	3
4	3
5	3
6	3
7	3
8	3
9	3
10	2

* As is always the case with casting, there is a tendency towards overscoring.

The sum of scores for the cranial vault (landmarks 1 through 7) is 21.

The sum of scores for the anterior cranium (landmarks 6 through 10) is 14. This corresponds to an estimated age of 56.2 +/- 8.5 years.

Individuals with this degree of generalized sutural ossification are most certainly adults, older than 30 years of age, and most often, older than 50 years of age.

SUMMARY:

1. Race: White.
2. Sex: Female.
3. Age: Older than 30 years, most likely older than 50 years.
4. Features compatible with a diagnosis of Down syndrome.
 - a. Clinical correlation including antemortem genetic studies would be required to verify this diagnosis.
5. No evidence of trauma.

EDUCATIONAL RESOURCES:

1. This is a good example of a White female skull. It serves as an important discussion piece for the concept of osteologic racial assignment, including especially, where Hispanic individuals may fall within the osteologic spectrum of race. This individual, who was known to be Hispanic, has a preponderance of non-metric traits within the White spectrum.
 - a. The concept of race assessment is controversial. It may be worthwhile to review the varying schools of thought on this issue. Short summaries from the perspective of the forensic anthropologist[2] and forensic pathologist[3] are readily available.
 - b. In many circumstances, the skull alone will allow an investigator to correctly determine sex.[4] However, the findings in the skull should never be treated in isolation; rather, they should be incorporated into your 'whole case' database. This database should include information obtained from all other aspects of the case. From an osteologic perspective, this includes (importantly) the bones of the pelvis.
2. Age assessment of skeletal remains is best done in the context of the entire skeleton. Assessment of the degree of suture closure can be used with some degree of success[1]; however, there is tremendous variability in the degree of closure process. Students must be cautioned that statistical data is based on **populations**, and may not necessarily be reflective of reality in an **individual**.
3. This is a good example of a skull of an individual with Down syndrome. The classical features are said to include a flat occiput, brachycephaly, nasal bone hypoplasia, delayed suture closure, small orbits, hypertelorism, frequent metopism with other sutural abnormalities, and an ogival palate.[5]
4. It may be worthwhile discussing the importance of correctly identifying frontal vascular grooves as a normal variant (these have been incorrectly labeled as sharp force injuries in some cases).

REFERENCES:

1. Meindl, R.S. and Lovejoy, C.O. (1985). Ectocranial suture closure: a revised method for the determination of skeletal age at death based on the lateral-anterior sutures. *American Journal of Physical Anthropology*, 68(1): 57-66.
2. Gill, G. (1998). Craniofacial criteria in the skeletal attribution of race. In *Forensic Osteology: Advances in the Identification of Human Remains*, K. Reichs, Editor. Springfield, IL: Charles C. Thomas.
3. Matshes, E. and Lew, E. (2006). Forensic osteology. In *Forensic Pathology: Principles and Practice*, D. Dolinak, E. Matshes, and E. Lew, Editors. San Diego, CA: Elsevier (Academic Press).
4. Krogman, W. and Iscan, M. (1986). *The Human Skeleton in Forensic Medicine*. 2 ed. Springfield, IL: Charles C. Thomas.
5. Aufderheide, A. and Rodriguez-Martin, C. (1998). *The Cambridge Encyclopedia of Human Paleopathology*. Melbourne, Australia: Cambridge University Press.

DISCLAIMERS:

This report is meant only as a teaching tool for introductory level students of the anatomical, anthropology or forensic sciences who might be using this specimen to learn human and forensic osteology. Evaluation of osteologic material is best done with original specimens. My evaluation was based solely upon studies of a Bone Clones® replica. My opinions are based solely upon the material presented to me. This is somewhat artificial as in real forensic investigations additional studies would be undertaken prior to the formulation of diagnoses and the production of a report. These studies might include plain film radiography, computed tomography (CT) studies, histology, etc. My opinions regarding race and sex are based only upon non-metric analyses. Evaluation of cranial suture closure is most accurately assessed endocranially as the sutures are known to close from the endocranial table towards the ectocranium. My opinions regarding this skull were made without access to the postcranial skeleton.

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Bone Clones Disclaimer on Ancestry Assessment

The assessment of ancestry from human skeletal remains, particularly the skull, is a component historically included in the creation of a biological profile for forensic purposes. This practice involves the analysis of morphoscopic traits and metric variables that may exhibit population-specific patterns of variation. However, it is important to recognize the significant scientific and ethical limitations of this practice.

Race is not a biologically valid concept. Contemporary biological anthropology holds that race is a social construct with no discrete biological basis. Human variation exists on a continuum, shaped by complex interactions between genetics, environment, and culture—not distinct “racial” categories. Therefore, the identification of “race” or “ancestry” based solely on skeletal features is scientifically problematic and cannot be performed with high accuracy or precision.

Although some morphological traits of the cranium may reflect broad population-level patterns due to shared evolutionary history, these traits do not map neatly onto socially defined racial categories. Furthermore, categories such as “Asian,” “European,” or “African” are socially constructed labels that do not fully capture genetic or phenotypic diversity, and they should not be interpreted as exact or absolute identifiers. As such, ancestry estimation based on skeletal features should not be interpreted as the identification of race, and results should be presented with appropriate caution and clear communication of limitations.

Historically, law enforcement agencies have requested ancestry estimations as part of forensic reports. However, many biological anthropologists today are increasingly hesitant to include this component, as doing so may inadvertently reinforce outdated and harmful typological thinking—the idea that humans can be classified into discrete biological “types” based on physical features. Such typologies have a long and problematic history and are not supported by modern science.

In cases where ancestry estimation is included, it is done with the understanding that it is a probabilistic assessment—not a definitive classification—and it must be contextualized within a broader ethical framework that prioritizes scientific integrity, individual dignity, and the avoidance of reinforcing racial stereotypes.