

SKELETONS: Museum of Osteology

Forensic Pathology: Human Skulls

Teacher Resource

Grade Levels: 9th – 12th Grade

9-12th Grade:

Florida Next Generation Sunshine State Science Standards

SC.912.N.1.1 - Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:

1. **Pose questions about the natural world**, (Articulate the purpose of the investigation and identify the relevant scientific concepts).
2. **Conduct systematic observations**, (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).
3. **Examine books and other sources of information to see what is already known**,
4. **Review what is known in light of empirical evidence**, (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. **Plan investigations**, (Design and evaluate a scientific investigation).
6. **Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs)**, (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. **Pose answers, explanations, or descriptions of events**,
8. **Generate explanations that explicate or describe natural phenomena (inferences)**,
9. **Use appropriate evidence and reasoning to justify these explanations to others**,
10. **Communicate results of scientific investigations, and**
11. **Evaluate the merits of the explanations produced by others**

SC.912.N.1.2 - Describe and explain what characterizes science and its methods.

SC.912.N.1.3 -- Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.

SC.912.N.1.5 - Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.

SC.912.L.14.1 - Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.

SC.912.L.14.6 - Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.

SC.912.L.14.12 - Describe the anatomy and histology of bone tissue.

SC.912.L.14.15 - Identify major markings (such as foramina, fossae, tubercles, etc.) on a skeleton. Explain why these markings are important.

SC.912.L.14.27 - Identify the functions of the major parts of the brain, including the meninges, medulla, pons, midbrain, hypothalamus, thalamus, cerebellum and cerebrum.

SC.912.L.16.10 - Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.

SC.912.L.16.11 - Discuss the technologies associated with forensic medicine and DNA identification, including restriction fragment length polymorphism (RFLP) analysis.

Program Overview:

Forensic Pathology: Human Skulls is a lab based program focusing on the deviation from a healthy or normal structure or function to reveal an abnormality, illness, or malformation of the human skull. After a basic introduction to skull osteology, pathology, and lab procedures, students will break-up into teams using a variety of tools from their forensic science kit to evaluate and document key evidence to support their results. They will then defend their findings to the class. Museum quality replicas of human skulls are used in this program.

Learning Objectives:

- Participants will successfully identify various pathological signatures to the skull and associated dentition.
- Participants will successfully utilize forensic measuring instruments to perform their evaluation.
- Participants will successfully work as teams in a lab environment— to document the expressed symptoms, research these symptoms, and communicate their findings to the class.

Background:

In this program, forensic pathology is the process of analyzing defects to the human skull and associated dentition that are the result of a disease or illness. Detailed cranial/dental measurements; knowledge of pathology signature/patterns; and comprehensive documentation are essential to forensic pathology.

Vocabulary:

- Forensic Science
- Pathology
- Frontal Bone
- Parietal Bone
- Occipital Bone
- Temporal Bone
- Squamous
- Nasal Bone
- Maxillary Bone
- Palatine
- Sagittal Suture
- Coronal Suture
- Squamosal Suture
- Lambdoidal Suture
- Bregma
- Lambda
- Orbit
- Occipital Condyle
- Foramen Magnum
- Zygomatic Arch
- Supra-orbital Ridge
- Mandible
- Incisor
- Canine
- Premolar
- Molar
- Mastoid Process
- Occipital Protuberance
- Sphenoid Bone
- Vomer
- Infraorbital/Supraorbital Foramen
- Mental Foramen
- Styloid Process
- Pterygoid process (medial/lateral)

- Wormian Suture
- Wormian Bone
- External Auditory Meatus
- Concha
- Adenoma
- Growth Hormone
- Craniostylosis
- Achondroplasia
- Mutation
- Attrition
- Toxicology
- Ballistics
- Trace evidence
- Serology
- DNA technology
- Prognathism

Reference: visit the SKELETONS: Museum of Osteology Education web page at:
<http://skeletonmuseum.com/education>

Recommended Reading:

Baker, Brenda J. Dupras, T., and Tocheri, M. W.

2005 *The Osteology of Infants and Children*. Texas A&M University Press

Fairgrieve, Scott I.

1999 *Forensic Osteological Analysis: A Book of Case Studies*. Charles C Thomas Publisher.

Gilbert, B. Miles

1990 *Mammalian Osteology*. Missouri Archaeological Society, Columbia, MO.

Guy, J. F.

2009 *Learning Human Anatomy: A Laboratory Text and Workbook*. Prentice Hal

White, Tim

1999 *Human Osteology*. Academic Press. Burlington, MA.

While at SKELETONS:

- Visit the Pathology Exhibit and have students point out various types of bone and skull pathology.
- At the Pathology Exhibit, discuss the various bone cells and the role they play in the bone remodeling process.
- Discuss how certain bone pathologies would influence skull and bone growth from birth to adulthood.
- Discuss sexual dimorphism in humans while visiting the Pathology Exhibit and Primate Exhibit.
- Have your students discuss the scientific approach they would use to evaluate the human skull for various types of abnormalities.