NO PREP

# Paleopathology

## Diseases Written in Bone

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# Paleopathology: Diseases Written in Bone

**What Is Paleopathology?**

The word 'paleopathology' combines the Greek roots for ancient (paleo) and disease (pathos), and it means exactly what it sounds like: the study of ancient disease. Paleopathologists examine skeletal and mummified remains to identify evidence of illness, injury, nutritional deficiency, and congenital conditions in past populations. The field sits at the intersection of medicine, archaeology, and history, and its findings can be startling. Diseases that seem distinctly modern — cancer, cardiovascular disease, diabetes-related conditions — have been found in remains thousands of years old. Diseases that we might associate with ancient or medieval times — plague, tuberculosis, leprosy — have left detailed physical signatures in bone that allow their history to be traced across centuries and continents. Not every disease leaves evidence in bone. Many illnesses kill quickly, before skeletal changes can develop. Respiratory infections, most viral diseases, and many bacterial infections leave no trace in the skeleton at all. This means the paleopathological

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## Tuberculosis and Leprosy: The Ancient Killers

Tuberculosis (TB) is one of the most important and well-documented ancient diseases in the paleopathological record. Caused by Mycobacterium tuberculosis, TB most commonly affects the lungs, but in a significant percentage of cases, it spreads to the skeleton, particularly the spine. Spinal TB causes the vertebrae to collapse

and fuse in a distinctive angular deformity called Pott's disease, or gibbus deformity. This pattern is so characteristic that paleopathologists can diagnose TB in a skeleton with considerable confidence even without any laboratory confirmation. Evidence of TB has been found in Egyptian mummies, in Neolithic European skeletons, and in pre-Columbian American remains, proving that this disease has been with humanity for at least 9,000 years. Leprosy, caused by Mycobacterium leprae, leaves equally recognizable skeletal signatures. The disease attacks peripheral nerves and the small bones of the extremities: the hands, feet, and face. In advanced cases, it causes the nasal bones to collapse, the small bones of the fingers and toes to be resorbed, and the facial bones to develop distinctive pitting. Medieval Europe had thousands of leprosaria (leper hospitals), and archaeological excavations of their associated cemeteries have provided extensive evidence of how the disease progressed and who it affected. DNA analysis of ancient M. leprae has even allowed researchers to trace the geographic origins and spread of different strains, revealing that medieval leprosy in Europe likely arrived via trade routes from Asia.

**Syphilis: A Disease That Crossed Oceans**

Few diseases in the paleopathological record are more controversial than syphilis. The Columbian hypothesis argues that syphilis was brought to Europe by sailors returning from the Americas with Columbus in 1493. The historical evidence is striking: a sudden epidemic of a virulent disease with syphilitic symptoms swept through Europe in the 1490s, killing tens of thousands within a few years. If syphilis was indeed introduced to Europe from the Americas, it would be one of the best-documented examples of a disease crossing an ocean and devastating a naive population with no prior immunity. Syphilis caused by Treponema pallidum leaves distinctive lesions on bone, a pattern of erosive pitting and new bone formation on the skull and long bones called caries sicca. Paleopathologists have identified these lesions in pre-Columbian American skeletons dating back thousands of years, consistent with the disease originating in the Americas. However, some researchers claim to have identified possible syphilitic lesions in pre-Columbian European remains as well, which would challenge the Columbian hypothesis. The debate continues, and each new ancient DNA study of Treponema organisms from different locations adds data to an ongoing scientific argument. What is not in dispute is that syphilis,

wherever it originated, caused devastating epidemics and has left abundant skeletal evidence of its global spread.

**The Black Death in Bone: What Mass Graves Reveal**

The Black Death — the catastrophic plague epidemic that killed an estimated one-third to one-half of Europe's population between 1347 and 1351 — has been extensively studied through archaeological evidence. Plague cemeteries and mass burial sites from this period have been excavated across Europe, and the skeletal evidence they contain reveals the human cost of the epidemic in ways that documentary sources cannot. The DNA of Yersinia pestis, the bacterium that causes plague, has been successfully extracted from the teeth of medieval victims, confirming the identity of the pathogen and allowing researchers to trace the geographic spread of different plague strains. What the skeletal evidence from Black Death burials reveals goes beyond the individual — it shows how societies responded to mass death. Normal medieval burial practice involved individual graves oriented east-west in consecrated ground, with careful placement of the body. Black Death burial sites often show the opposite: mass graves with bodies stacked in no particular order, no grave goods, no careful orientation. This archaeological signature of social collapse — the inability to bury the dead with normal ritual care — is itself evidence of how overwhelming the epidemic was. When a society runs out of gravediggers, when the living are too few and too sick to bury the dead individually, the graves themselves become a record of catastrophe.

**Key Information: Paleopathology and Ancient Diseases**

| Disease / Condition | Skeletal Evidence | Historical Significance |
|---|---|---|
| Tuberculosis (TB) | Pott's disease: angular vertebral collapse and fusion | Found in remains 9,000+ years old; predates written history |
| Leprosy | Nasal bone collapse, resorption of finger/toe bones, facial pitting | Medieval leprosaria cemeteries document disease spread via trade routes |

| Disease / Condition | Skeletal Evidence | Historical Significance |
|---|---|---|
| Syphilis | Caries sicca: erosive pitting on skull and long bones | Debate over Columbian hypothesis — Americas origin supported by most evidence |
| Plague (Black Death) | Yersinia pestis DNA extracted from teeth; mass burial patterns | Mass graves reveal social collapse when death rates overwhelmed normal burial practices |
| Malnutrition | Harris lines, porotic hyperostosis, rickets bone deformation | Reveals food insecurity and diet quality across ancient populations |
| Cancer | Erosive lesions or abnormal bone growths | Documented in ancient Egyptian mummies — cancer is not a modern disease |
| Arthritis | Joint surface degeneration, bone spur formation | Common in skeletal remains; reveals aging patterns and labor demands |

**Case Study: The Plague Pit of Krakow**

**Dr. Anna Kowalski has been excavating medieval burial sites in Poland for fifteen years. She has seen a lot. But the feature her team uncovered in the third week of the Krakow churchyard project is different from anything she has encountered before. It started as a soil anomaly — a large rectangular area where the earth had a different color and texture than the surrounding matrix. When they began to excavate, they found not one skeleton but dozens, layered on top of each other with no apparent order. No grave goods. No careful orientation. Some of the skeletons are face-down. Several show evidence that the bodies were simply dropped in from above, their bones disarticulated in ways that suggest they were not arranged at all. Anna kneels at the edge of the feature. 'This is not a normal burial,' she says to her team. 'Look at the density. Look at the disorganization.' She takes a tooth sample from three of the skeletons. She is already fairly certain what the lab will find — she has seen the same pattern in excavations in France and England. But she needs confirmation. 'The bones alone are telling me something,' she says. 'When people have time and resources and community, they bury their dead with care. When something takes away all three of those things at once — that is what this looks like. This is what catastrophe looks like, written in the ground.'**

1. Using the reading passage, explain what the burial pattern at Anna's site reveals about how the community was functioning at the time of death — and what disease the tooth samples are likely to confirm.

2. The reading states that the paleopathological record is biased toward chronic conditions. How does the Black Death burial evidence both support and challenge this claim?

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**Multiple Choice**

1. What is paleopathology?

    a) The reconstruction of ancient diets using isotope analysis

    b) The analysis of chemical changes in soil around ancient burial sites

    c) The study of ancient plants preserved in archaeological sites

    d) The study of ancient diseases through skeletal and mummified remains

2. What skeletal condition is characteristic of tuberculosis infection?

    a) Gibbus reversal — abnormal forward curvature of the lumbar spine

    b) Porotic hyperostosis — porous patches on the outer skull surface

    c) Pott's disease — angular collapse and fusion of the vertebrae

    d) Caries sicca — erosive pitting on the skull and long bones

3. What does a Black Death mass burial site tell archaeologists about medieval society?

    a) Medieval people did not have formal burial customs before the plague arrived

    b) The chaotic mass burials show that the epidemic overwhelmed the community's ability to follow normal funeral practices

    c) Mass burials were the standard practice in medieval Poland and France regardless of whether any outbreak was under way

    d) The victims were deliberately buried without ritual to prevent the spread of infection

**Matching**

Write the letter of the correct definition on the line next to each term.

| Term | Definition |
|---|---|
| 1. ___ Paleopathology | A) Physical changes preserved in bone that allow researchers to identify disease or injury in the past |
| 2. ___ Lesion | B) Bacterial disease that can cause vertebral collapse (Pott's disease) when it spreads to the spine |
| 3. ___ Tuberculosis | C) A widespread outbreak of infectious disease affecting a large population in a short period |
| 4. ___ Epidemic | D) The study of ancient disease through analysis of preserved skeletal and mummified remains |
| 5. ___ Skeletal evidence | E) An area of abnormal tissue change in bone caused by disease, injury, or infection |

**Fill-in-the-Blank**

1. The study of ancient diseases through skeletal evidence is called _____.

2. Abnormal changes in bone caused by disease or injury are called _____.

3. The distinctive angular collapse of the vertebrae caused by tuberculosis is called _____ disease.

**Short Answer**

Answer each question in 2-4 complete sentences.

1. How can paleopathologists tell the difference between skeletal damage caused by disease versus injury versus normal aging?

2. What does the geographic spread of syphilis in the archaeological record tell us about contact between the Old and New Worlds?

3. Why is studying ancient disease patterns useful for modern medicine and public health?