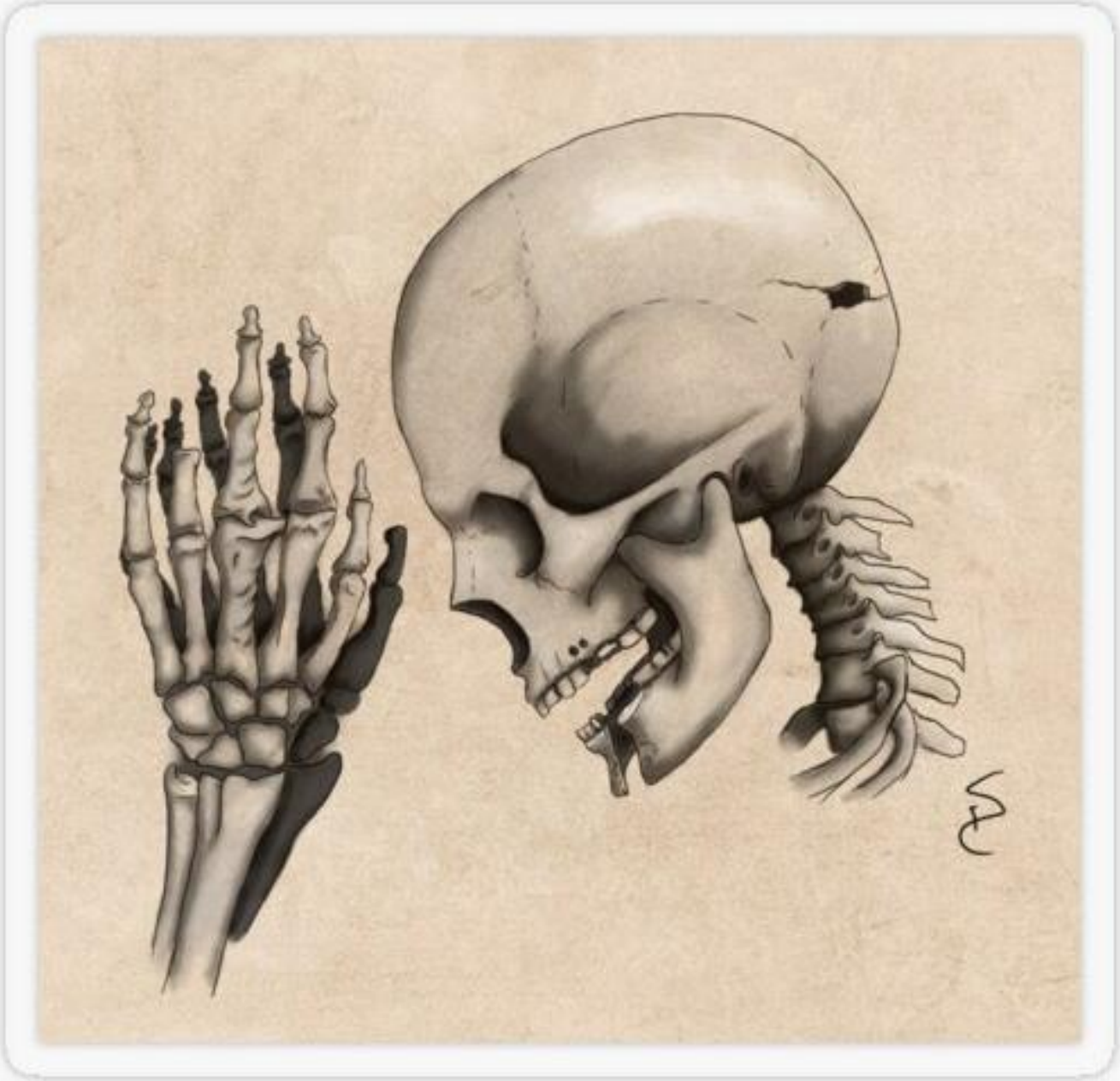
PALEOPATHOLOGY

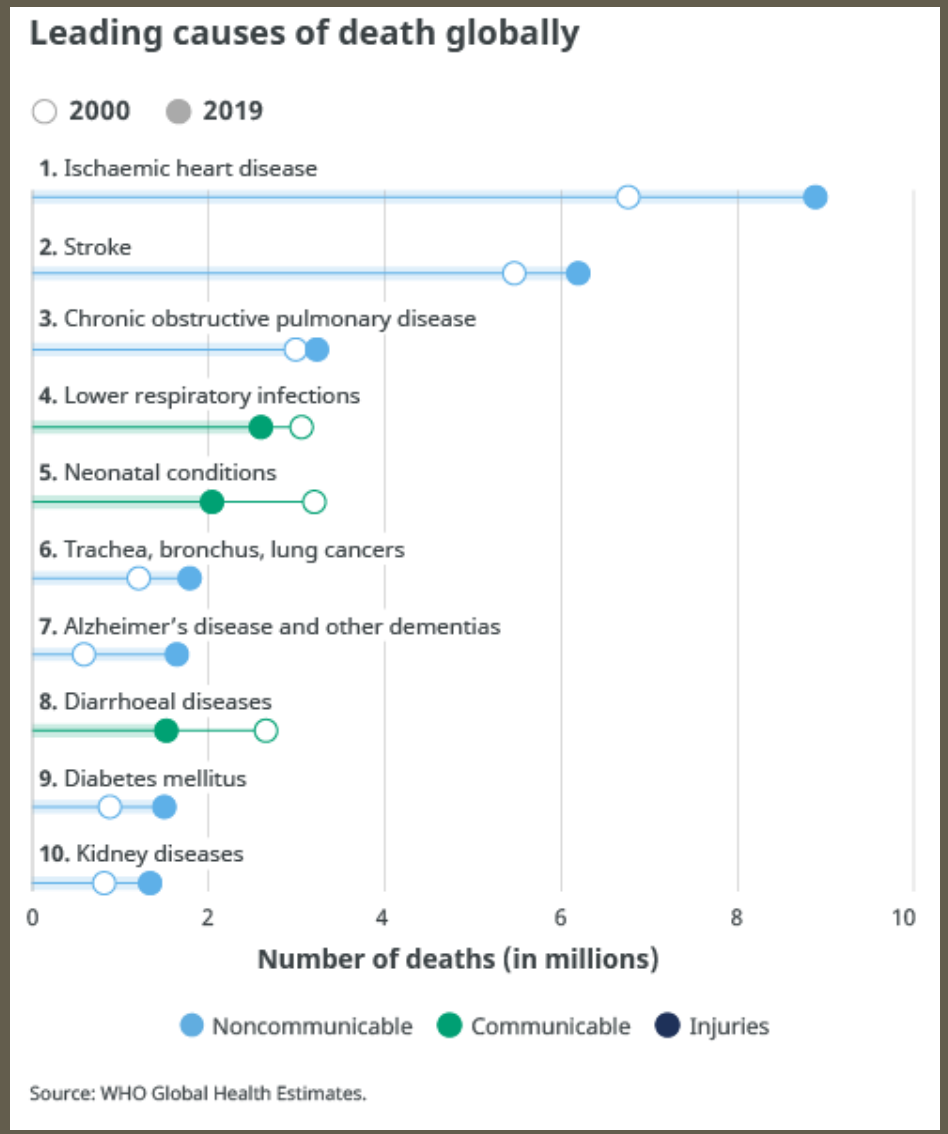
Dr Arwa Kharobi

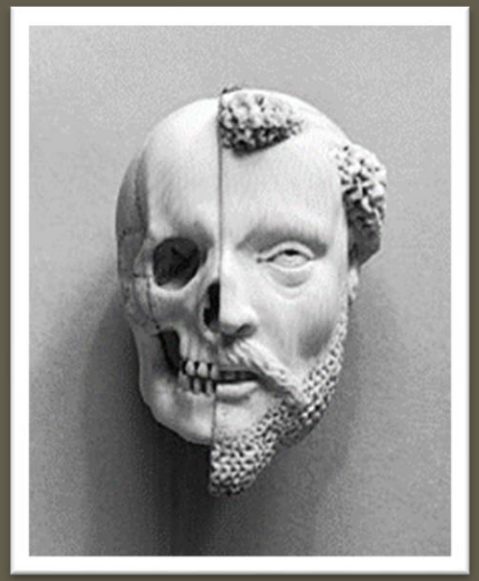


"CASE STUDIES" VERSUS "POPULATION STUDIES "

IN PALEOPATHOLOGY

How we die?


Leading causes of death globally
2000
2019
1. Ischaemic heart disease
2. Stroke
3. Chronic obstructive pulmonary disease
4. Lower respiratory infections
5. Neonatal conditions
6. Trachea, bronchus, lung cancers
7. Alzheimer's disease and other dementias
8. Diarrhoeal diseases
9. Diabetes mellitus
10. Kidney diseases
0
2
4
6
8
10
Number of deaths (in millions)
Noncommunicable
Communicable
Injuries
Source: WHO Global Health Estimates.




R.I.P.

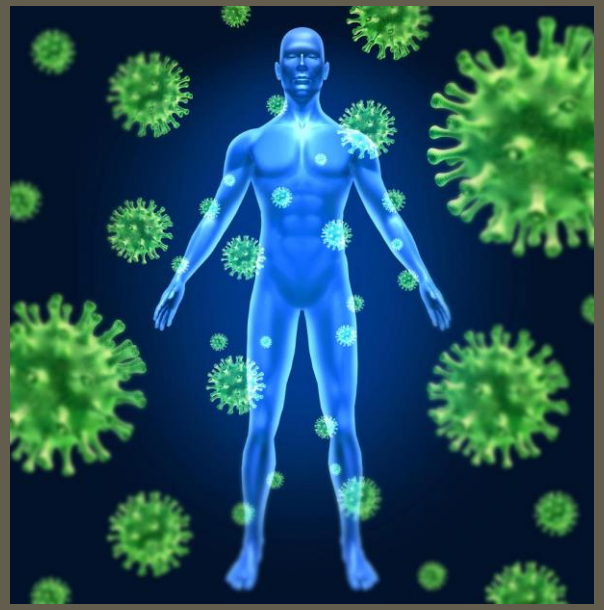
Explore the Causes of Death

A trauma, a natural death, or a disease?

What is a disease?

How does it occur?

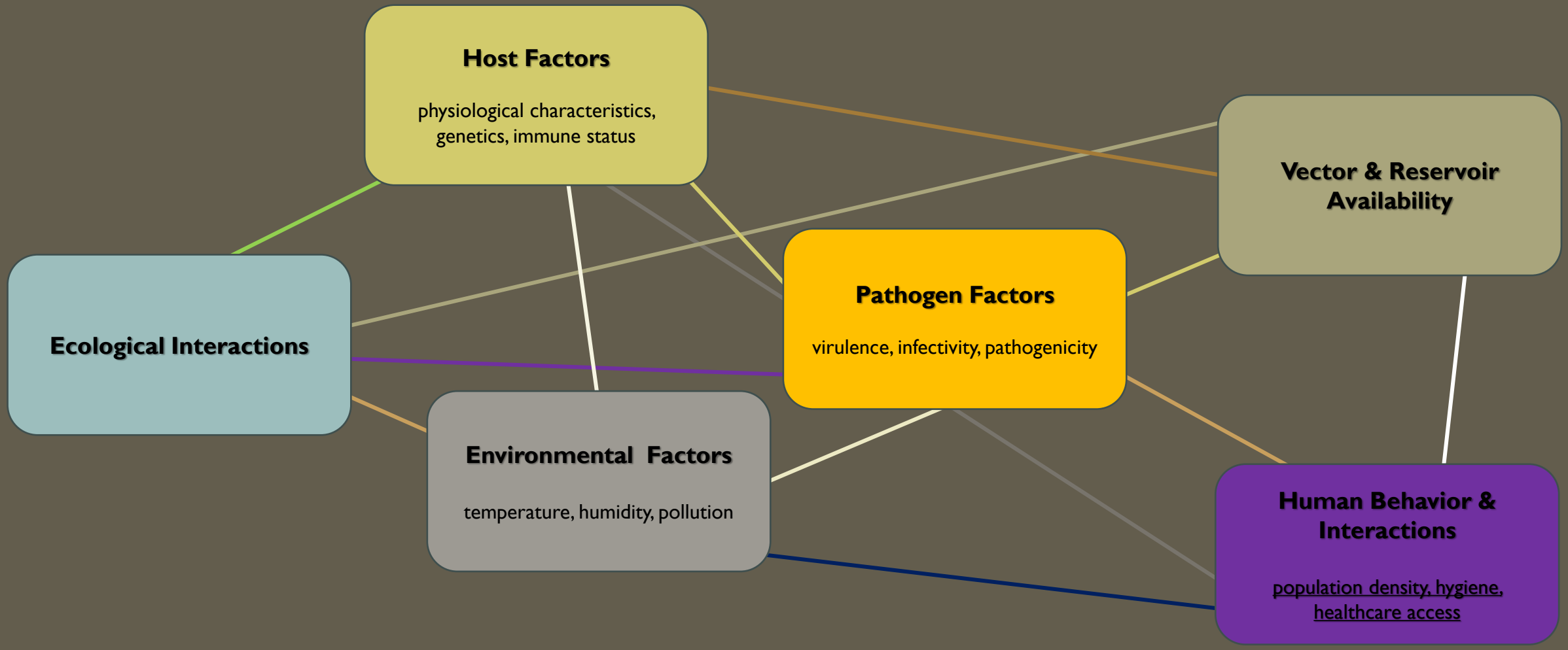
***disease**, any harmful deviation from the normal structural or functional state of an organism, generally associated with certain signs & symptoms and differing in nature from physical injury.*



Pathology

- determination of the cause of disease — etiology
- understanding of the mechanisms of its development — pathogenesis
- structural changes associated with disease process — morphological changes
- functional consequences of those changes

What are the physiological and ecological factors that influence the frequency of disease occurrence?



Disease's Categories

Infectious

- influenza
- tuberculosis
- malaria

Chronic

- diabetes
- cancer
- asthma

Genetic

- Cystic Fibrosis
- Huntignon's disease
- Sickle cell anemia

Autoimmune

- Multiple sclerosis
- Systemic lupus
- Rheumatoid arthritis

Mental Health Disorders

- depression
- anxiety disorders
- schizophrenia

Nutritional Deficiency Diseases

- scurvy
- rickets
- iron-deficiency anemia

Lifestyle-Related Diseases

- obesity
- type 2 diabetes
- cardiovascular diseases

Occupational Diseases

- silicosis

Environmental Diseases

- lead poisoning
- asbestos-related diseases

Degenerative Diseases

- Parkinson's disease
- ALS
- Alzheimer's disease

WHAT IS THIS?

Compare the 'suspicious' bones/teeth with normal bones/teeth

Eliminate the non-metric traits & post-mortem damage (taphonomy)

Use detailed descriptions

Recorded their distribution pattern

Consider possible (**Differential Diagnoses**)

Abnormalities: recognized

pathological lesions: noted

Diseases: defined

DIFFERENTIAL DIAGNOSES

it is only possible for the skeleton to react in a limited number of ways to the impact of disease

& therefore, similar bone changes can occur in different bone diseases

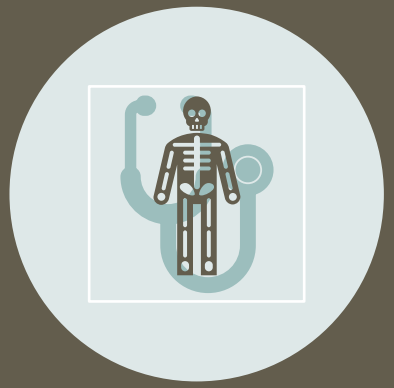
DIFFERENTIAL DIAGNOSES

For example,

- ✓ there are many different diseases that affect the joints,
- ✓ but different joints can be affected in different diseases
- ✓ it is therefore important to consider all diseases that could have created the bone changes

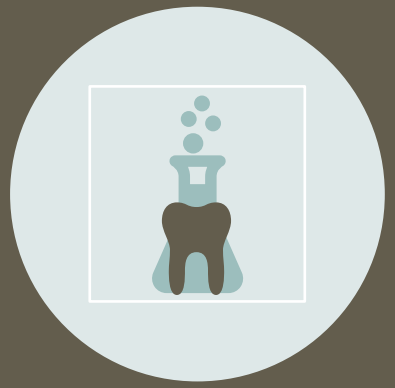
MACROSCOPIC

GROSS EVALUATION



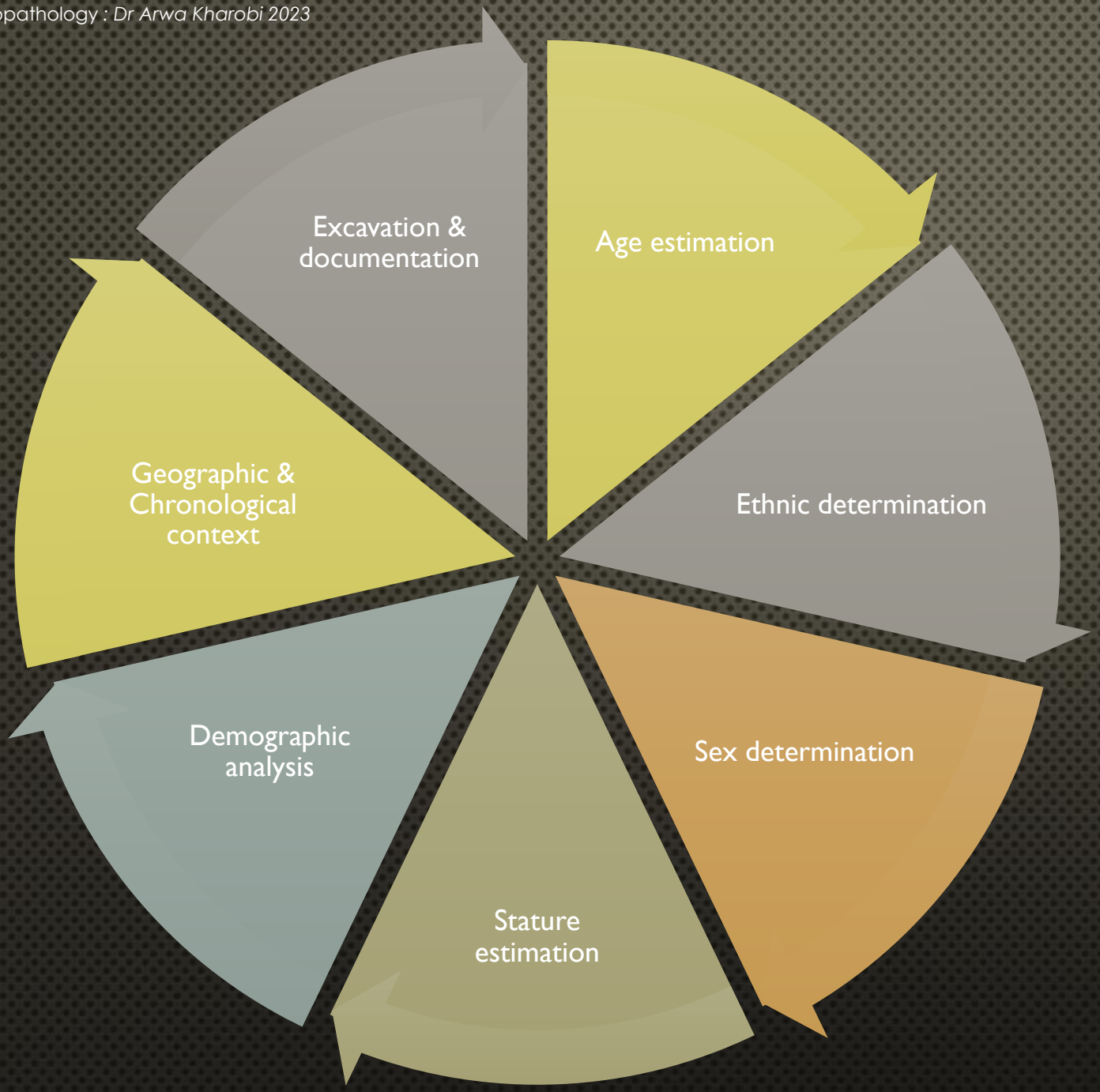
IMAGING

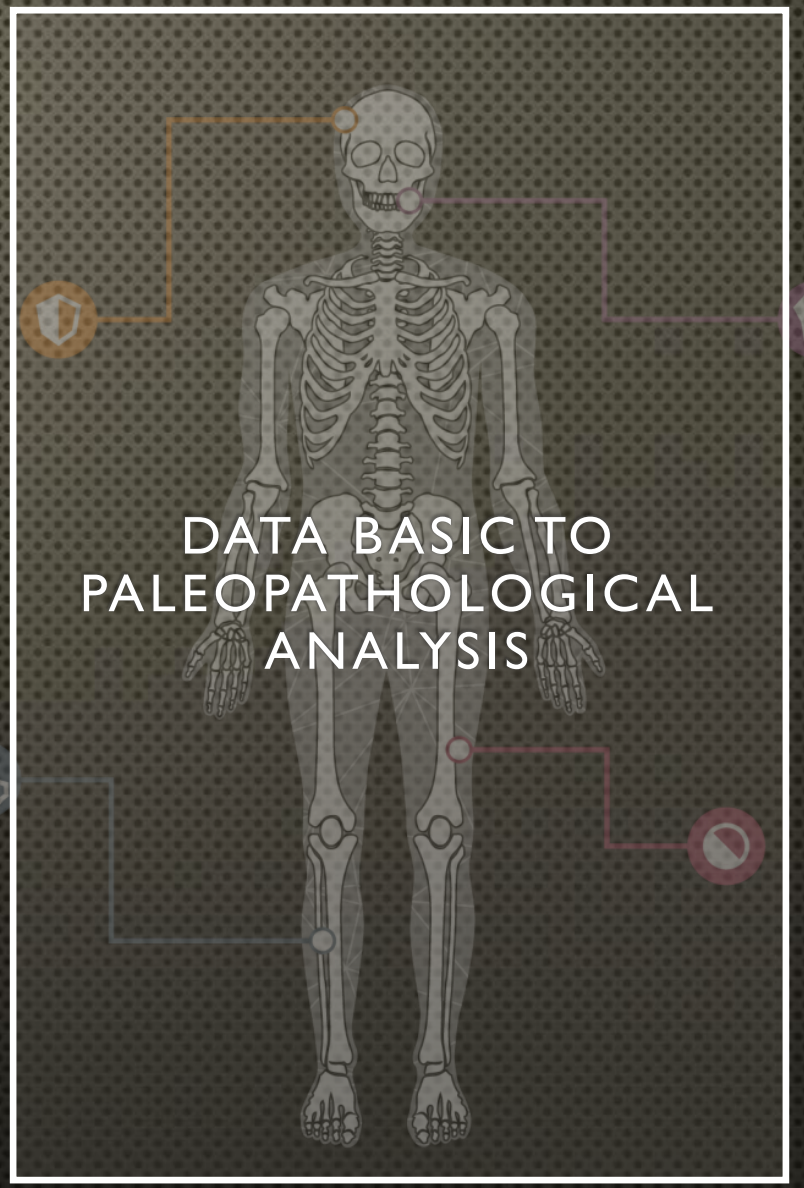
3D SCANNING, CT, X-RAYS



BIOCHEMICAL ANALYSIS

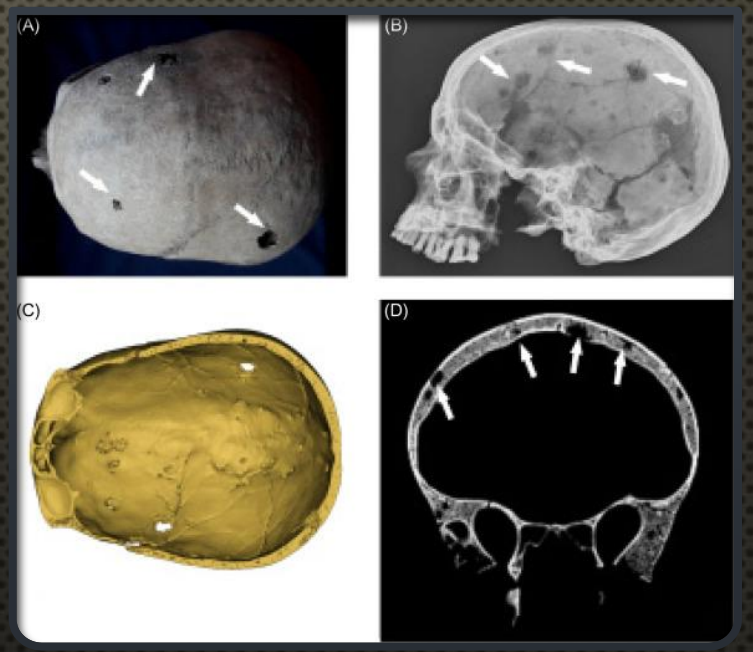
DNA, ISOTOPES


Excavation & documentation
Age estimation
Ethnic determination
Sex determination
Stature estimation
Demographic analysis
Geographic & Chronological context


DATA BASIC TO PALEOPATHOLOGICAL ANALYSIS

IMAGING

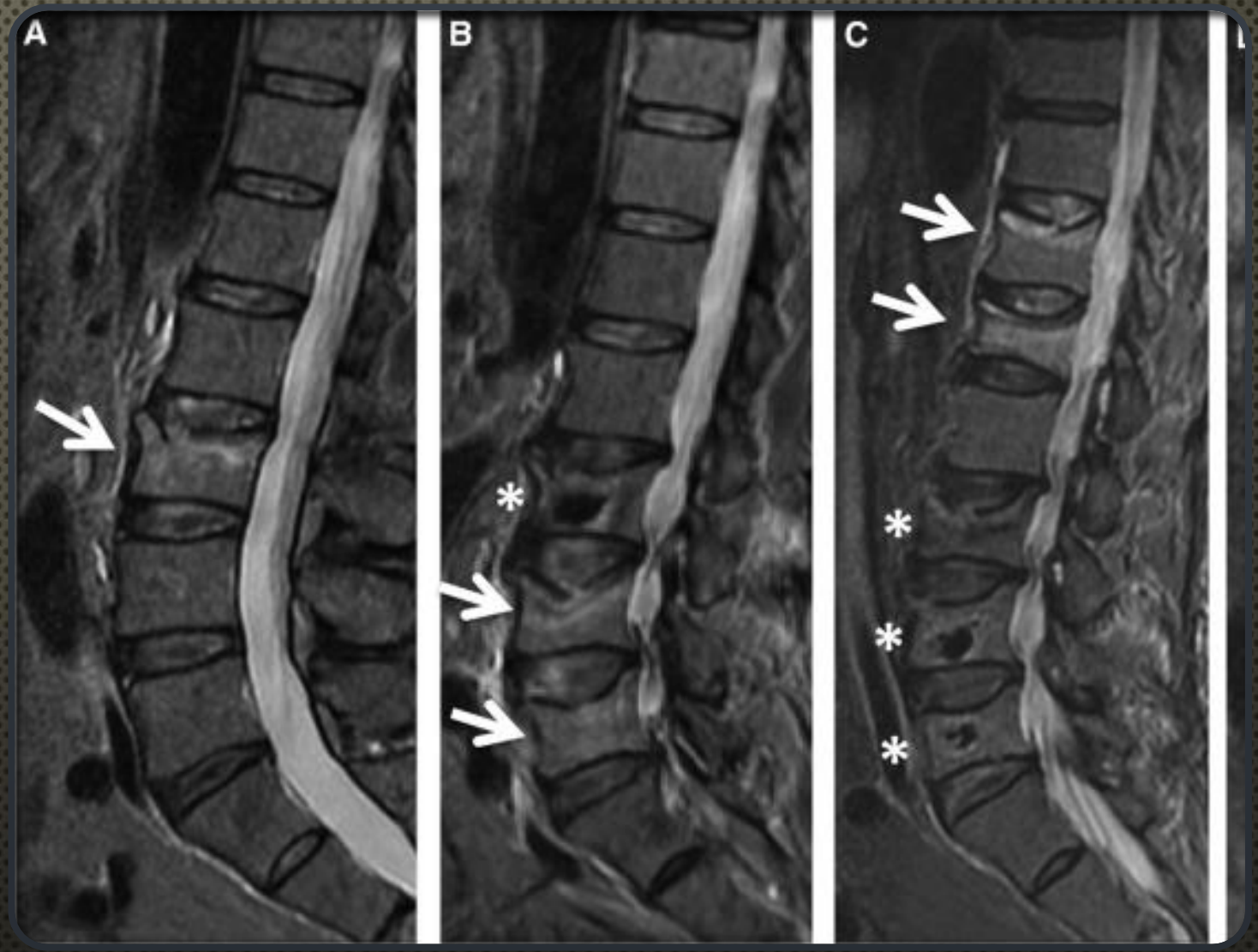
- Outstanding diagnostic tools
- Complementary to the macroscopic analysis
- Non-invasive and non-destructive
- Facilitate visualizing internal structures of bones
- Permanent digital documentation
- Indispensable for mummified remains



IMAGING

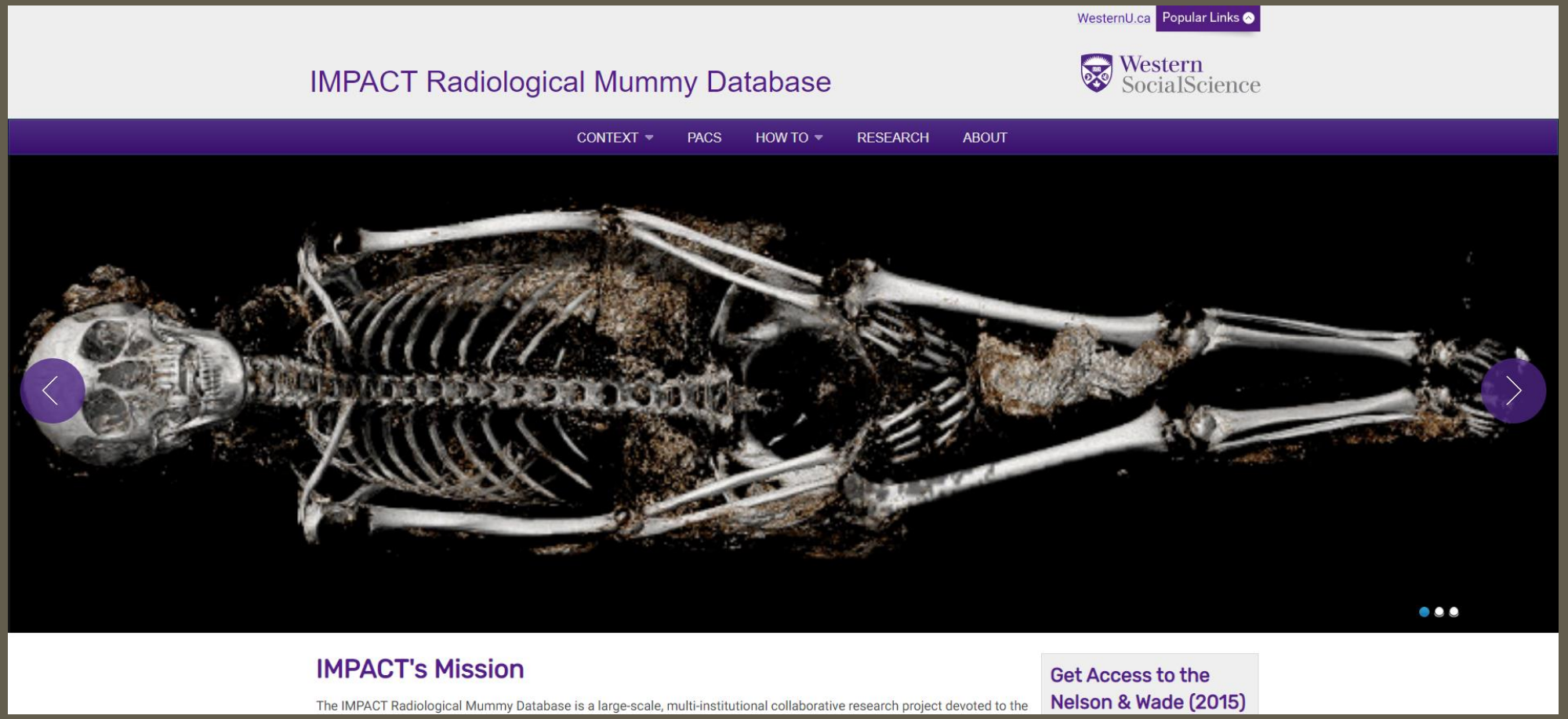
Some pathologies are invisible by gross evaluation as:

- osteoporosis,
- endosteal sclerosis,
- middle ear infection



Radiology of Osteoporosis, Link 2016

IMPACT: RADIOLOGICAL MUMMY DATABASE OF MUMMIES WWW.IMPACTDB.UWO.CA



Fayum Mummy

Impact ID: IMP00012

Institution: Redpath Museum

Designation: RM2720

Date of Acquisition: 1895

Contact: Dr. Andrew Nelson

(anelson@uwo.ca)

Image Modality: CT

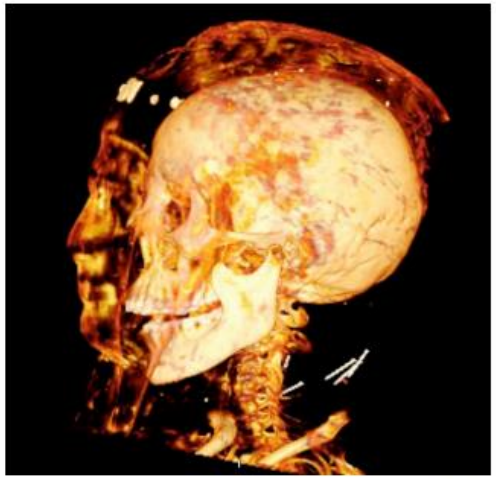


Figure 1. 3D image of head and mask of RM2720 (Wade et al., 2011)

Country: Egypt

Dig Site: Hawara el-Maktaa

Time Period: Roman

Dynasty: unknown

Sex: Female

Age: 18-24 years

Background:

In 1895, Sir Thomas Roddick donated a Fayum mummy to the well-established Redpath Museum. When writing to Sir William Dawson, geologist and university administrator of McGill University, Roddick stated the mummy was found in a tomb or solid rock pit at Hawara el-Maktaa, near the Pyramid of Amen, but the age is unknown (Lawson, 2016). Roddick is known to have travelled to Egypt himself on two occasions, serving in the Anglo-Egyptian War of 1882 and with the Camel Corps in 1884-1885 in the Nile Expedition (Lawson, 2016). In a biography about Roddick, it is noted that on the second visit to Egypt is the one in which he brought back a mummy that he donated to McGill to put in the Redpath museum (Lawson, 2016). There is still

ID: IMP00012
Sex: Male
Estimated Age: 30-50
Institution: Redpath Museum (Montreal)
Period: Roman
Site: Hawara el-Maktaa
Modality: CT

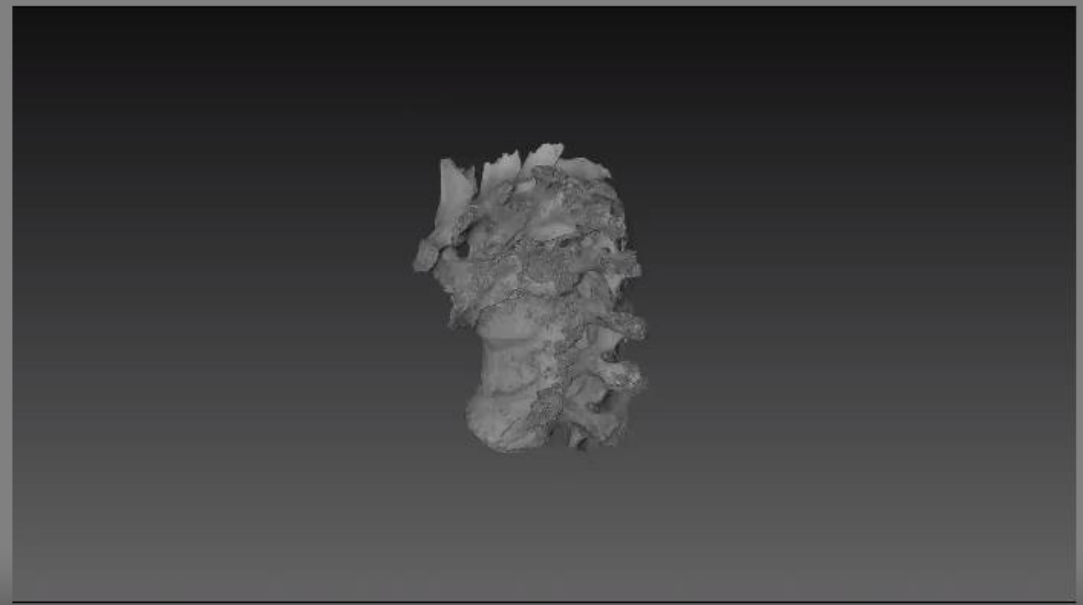
RM2720

Series #: 004
Number of Images: 961

Home | The project | The disease classification | The resource

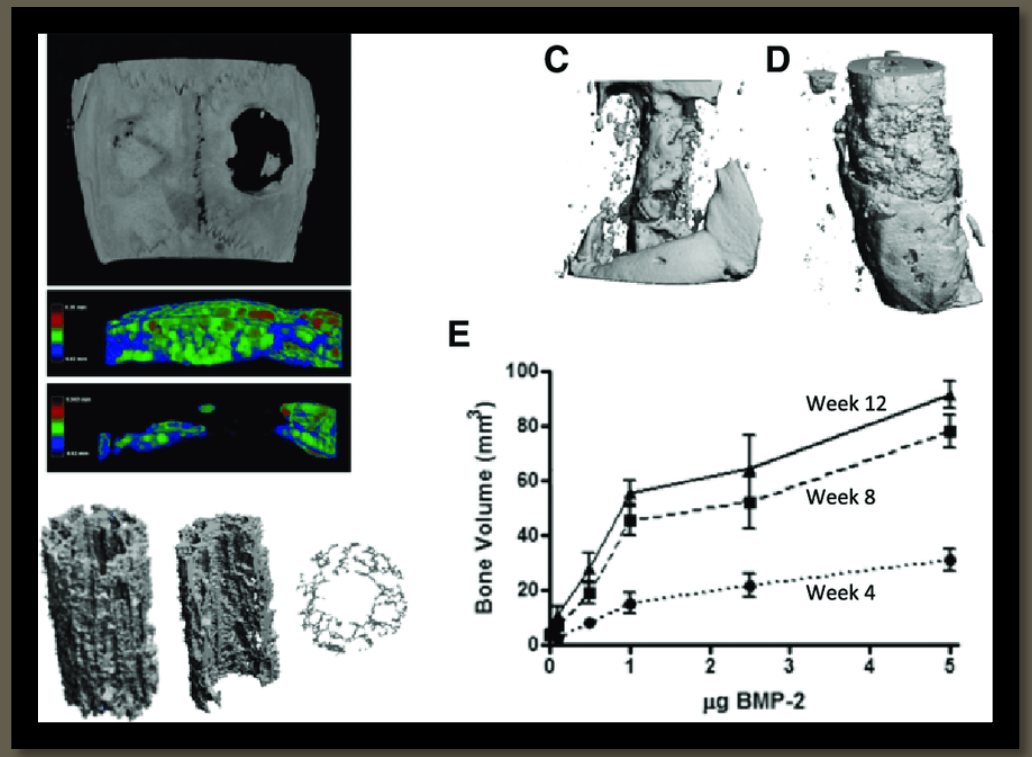
- Disease classification
- Developmental
- Traumatic
- Accidental
- Blunt-Force Trauma
- Dental trauma
- Dislocation
- Fractures
- Impingement
- Myositis ossificans traumatica
- Rotator cuff injury
- Subluxation
- Slipped epiphyses
- Intentional
- Surgical
- Activity-related / developmental weakness

***Digitised* Diseases** is an open access resource featuring human bones which have been digitised using 3D laser scanning, CT and radiography. The resource focuses on a wide range of pathological type specimens from archaeological and historical medical collections, specifically examples of chronic diseases which affect the human skeleton for which many of the physical changes are often not directly observable within clinical practice. Of major interest to many will be high fidelity photo-realistic digital representations of 3D bones that can be viewed, downloaded and manipulated on their computer, tablet or smartphone.



UNIVERSITY of BRADFORD | RCS | MUSEUM OF LONDON ARCHAEOLOGY | Jisc

OTHER IMAGING MODALITIES



microcomputed tomography

magnetic resonance imaging

BIOCHEMICAL ANALYSIS

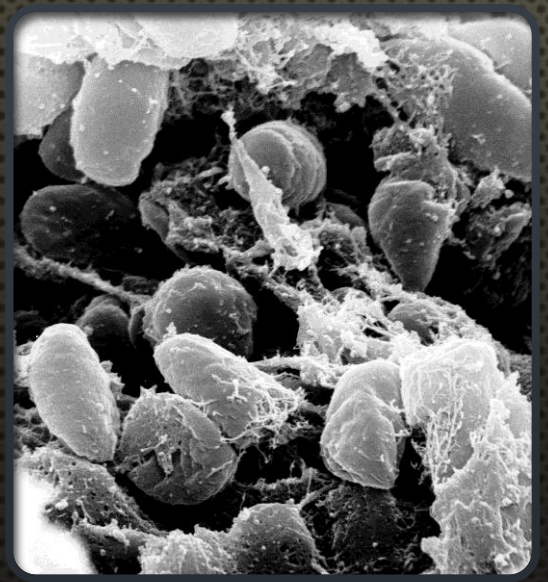
Genomes of pathogens through aDNA techniques challenging analysis, due to:

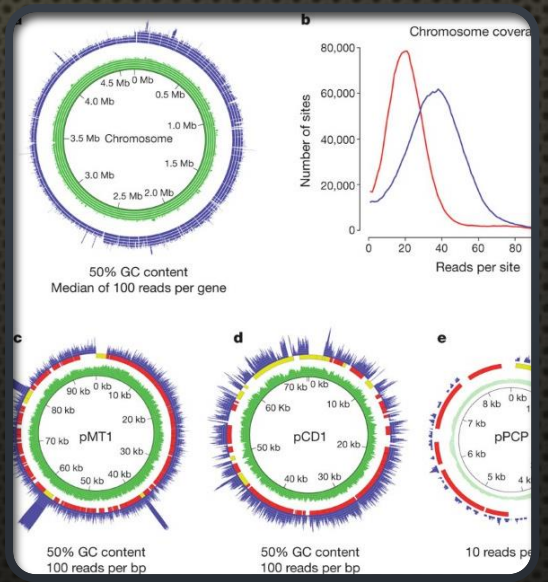
- Preservation
- Pathogen load & location in the body
- Environmental microbial contamination
- Current understanding of microbial pathogenicity

1348-1350 BLACK DEATH IN ENGLAND

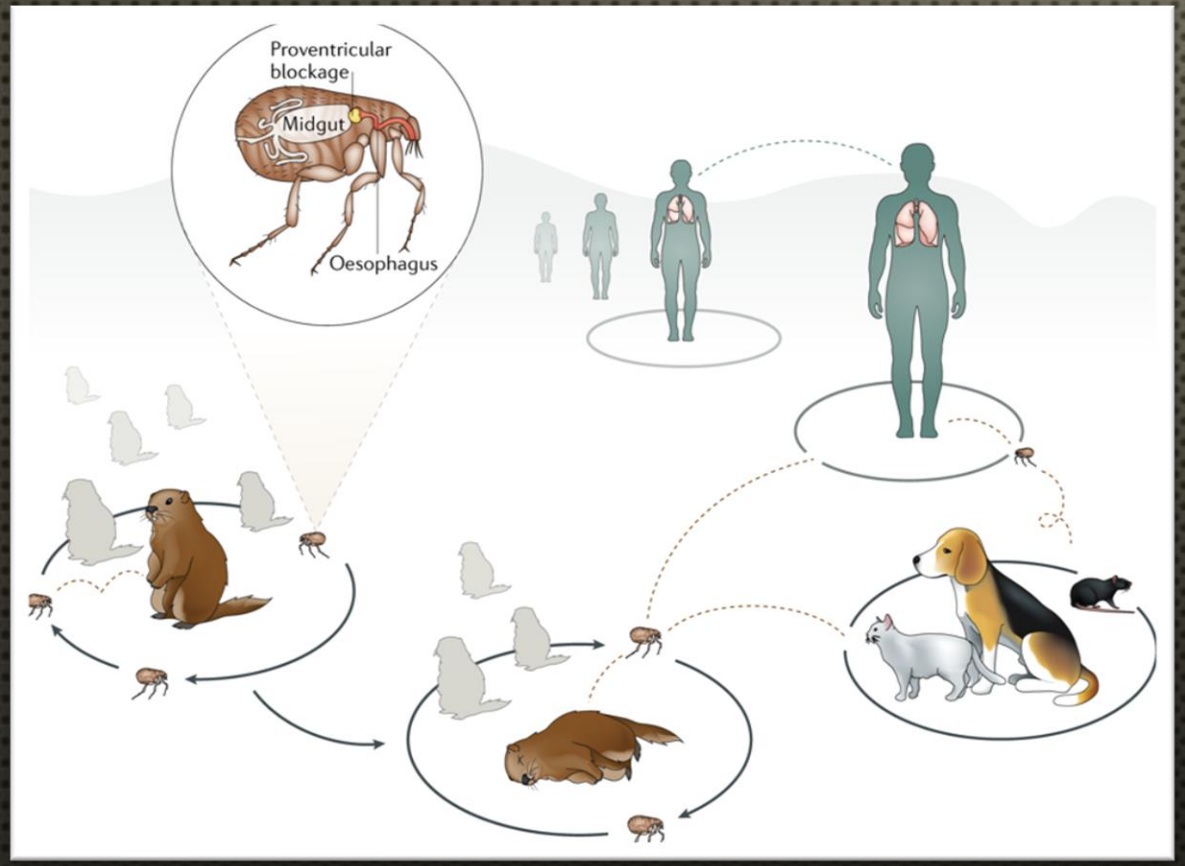
A study of the full genome from teeth and bones:

- increased virulence of the disease during the Black Death may not have been due to bacterial characteristics
- but due to a combination of climate, vector dynamics, social conditions & synergistivictimsc interactions with concurrent diseases





1348-1350 BLACK DEATH IN ENGLAND



A simplified version of the *Yersinia pestis* enzootic cycle, during which the bacterium is maintained among wild rodent populations through a flea-dependent transmission mechanism © Spyrou et al. 2019.

The **medieval plague** "was probably responsible for its introduction & widespread distribution in human populations.

"*pathogen implicated in the Black Death has close relatives in the 21st cent that are both endemic and emerging*"

LIMITS OF DNA IN PALEOPATHOLOGY

1. **Highly degraded aDNA sequences** (due to the preservation conditions) can limit the identification of the SNPs of metabolic pathways related to the pathologies

2. **Most genetic diseases are jointly caused by many genes and environmental factors** and identifying a disease-related haplo type yields information about a possible predisposition to a disease <u>but does not provide information on the manifestation of the disease on the analysed sample</u>

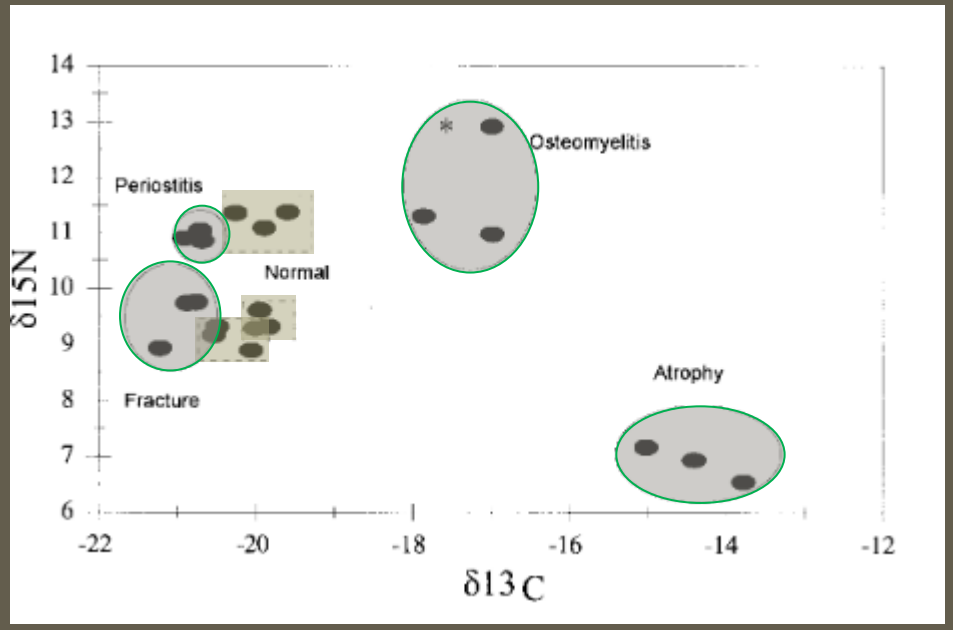
3. aDNA analysis is **costly and time-intensive**

the stable isotope method is the unique molecular method that can be efficiently used

ADVANTAGE OF USING ISOTOPIC ANALYSES

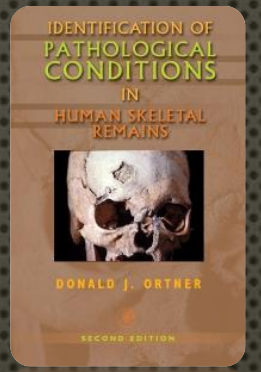
When:

- ✓ Pathology is not grossly visible
- ✓ In cases of nutritional stress, which is not always identifiable in the archaeological record



Graph ofd15N andd13C for normal and pathological bone samples, Katzenberg & Lovell 1999

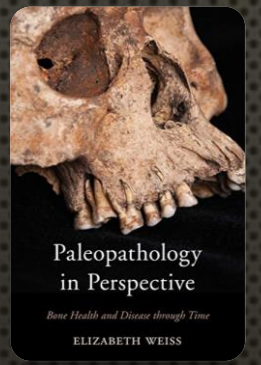
II. ABNORMAL BONE & PSEUDOPATHOLOGY

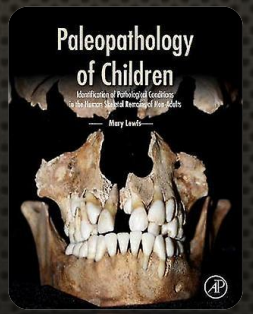


First decision to take: normal or not?

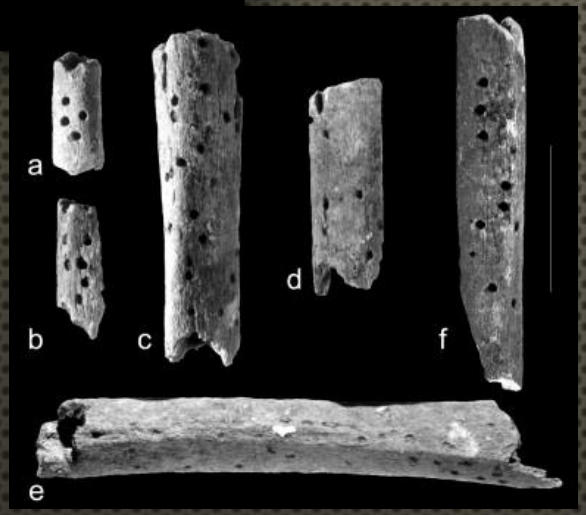
A very good grasp of what is normal? = good knowledge of anatomy + changes in all stages of growth & development

Variations from normal anatomy will provide the initial evidence of diseases





Dermestid beetles



Metopic ossicle & supranasal suture

Postmortem modifications 'PSEUDOPATHOLOGY'

- Burial environment
- Excavation tools
- Non anatomical traits
- Taphonomic alterations
- Anthropogenic disturbances

Skeletal diseases are expressed as:

1. **ABNORMAL BONE SIZE**
   - TOO SMALL?
   - TOO BIG?

2. **ABNORMAL BONE SHAPE**
   resulting from
   - Defects in growth & Development?
   - poorly mineralized bone or biomechanical loading?
   - poor alignment following fracture?

3. **ABNORMAL BONE FORMATION**
   - NEW BONE FORMATION?
     reactive, porous, straited, spiculated?
   - FORMATION OF COMPACT (LAMELLAR BONE?)
     smooth, porous, straited, spiculated, PLAQUE-LIKE FORMATION?

4. **ABNORMAL BONE DESTRUCTION**
   No margin or clear border -> no or with evidence of repair? Focal or generalized porous destruction? Destructive remodelling? Osteopenia? Fracture?

59-yr-old Female

1 ABNORMAL BONE SIZE

37-yr-old Female

© Terry Anatomical Collection, NMNH

+ Flaring distal femoral metaphyses & epiphyses

Characteristic of:

1 ABNORMAL BONE SIZE

Diagnosis:
Achondroplastic dysplasias

Disease: impairs the growth of bone in the limbs & causes abnormal growth in the spine & skull

79-yr-old Female

2

ABNORMAL BONE SHAPE

Adult NA

distinctive anterior pseudo-bowing produced by pathological apposition of new bone on the anterior surfaces of the diaphysis in a clinically

Characteristic of:

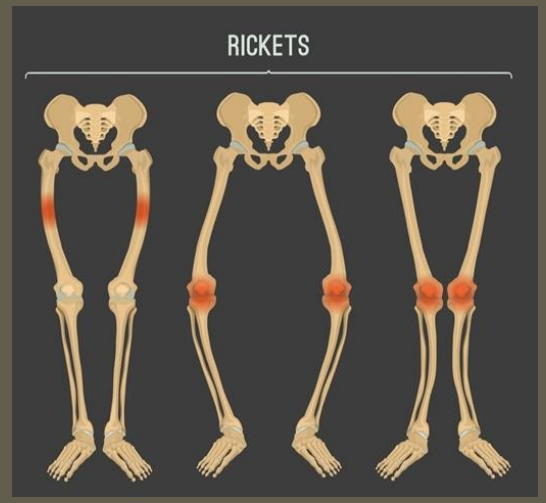
medial bowing and marked anteroposterior flattening of the diaphysis

Characteristic of:

2

ABNORMAL BONE SHAPE

Diagnosis:
venereal syphilis



Diagnosis:
rickets or
osteomalacia

Disease:

Syphilis is a bacterial infection usually spread by sexual contact

Rickets is a condition that affects bone development in children

75-yr-old Male

3 ABNORMAL BONE FORMATION

endosteal envelope of diaphysis leading to near total obliteration of the medullary cavity

Hypertrophy of both diaphyses

Contralateral lesions on the right are clearly not as severe but abnormal bone formation is still clearly present

Characteristic of:

3

ABNORMAL BONE FORMATION

Diagnosis:
Paget's disease

Disease:

(PAJ-its) disease interferes with body's normal recycling process, in which new bone tissue gradually replaces old bone tissue

Adult Male

4

ABNORMAL BONE DESTRUCTION

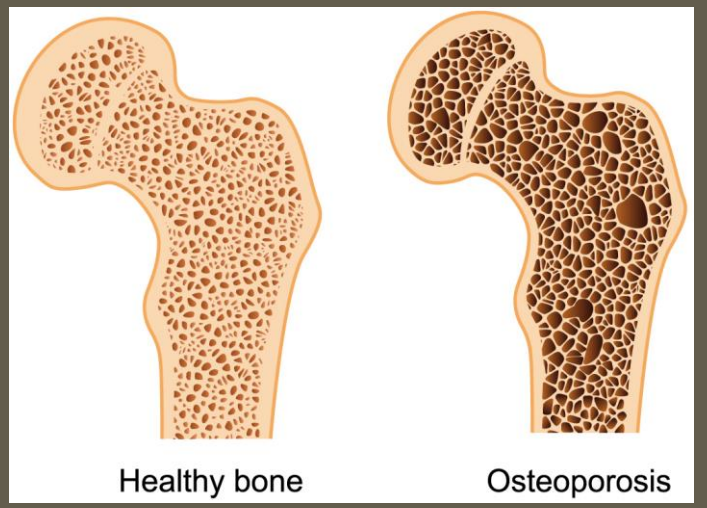
distal femoral diaphysis poorly reduced (aligned)

Characteristic of:

4

ABNORMAL BONE DESTRUCTION

Diagnosis:
Healed fracture

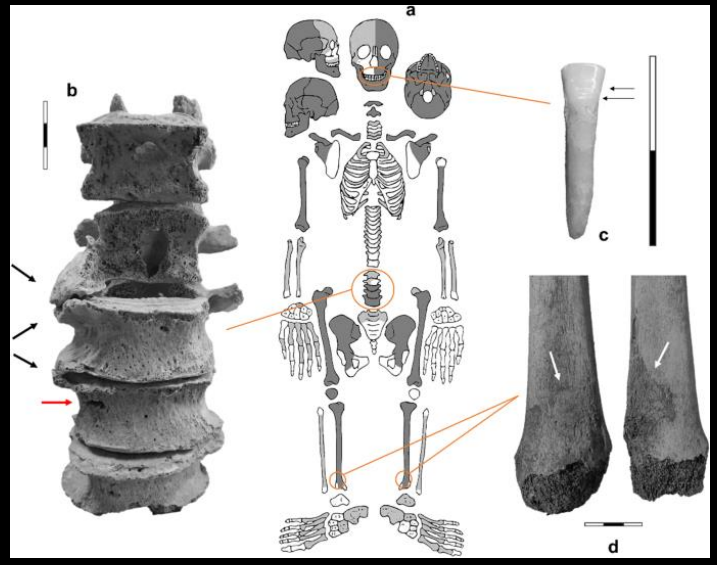


The most common causes of fractures (Broken Bones) are:

1. Trauma: A fall, accident, or tackle during a football game
2. Osteoporosis: This disorder weakens bones and makes them more likely to break
3. Overuse: Repetitive motion can tire muscles & place more force on bone (i.e., stress fractures)

- NOT ALL THE DISEASES ARE VISIBLE ON SKELETONS

- NOT ALL THE VISIBLE DISEASES ARE CAUSES OF DEATH



Infectious Disease?

Those diseases caused by biological agents varying from microscopic intracellular viruses to large, structurally complex helminthic parasites

Inhorn & Brown, 1997

Infectious Disease?

Any examples you know?

Those diseases caused by biological agents varying from microscopic intracellular viruses to large, structurally complex helminthic parasites

Inhorn & Brown, 1997

DENTAL CARIES

- Infectious disease process
- Demineralization of dental tissues by acids produced by bacterial fermentation of carbohydrates and sugars
- Infection can spread:

1. Within tooth structures (Enamel, Dentine, Pulp)
2. To other teeth
3. To alveolar bone
4. To other parts of the body through the blood

Factors Affecting Infectious Disease

Shift from foraging to farming, associated with:

- Increases in population size and density
- Permanent settlement
- Reduction in sanitation and hygiene
- Declining nutritional quality (dietary focus on domesticated plant carbohydrates-maize, wheat, rice)

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In combination, these factors facilitated pathogen transmission & the spread of infectious disease (not been seen before)

Factors Affecting Infectious Disease

In later periods, extensive migration spread infectious diseases to new locations

- Colonialism 15th -cent

20th cent-development of antibiotics to treat some forms of infection

- also led to antibiotic resistance, resulting in the emergence or reemergence of some forms of disease

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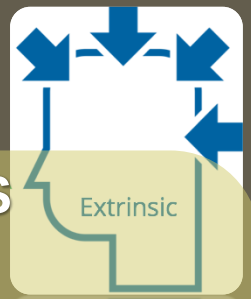
Factors Affecting Infectious Disease

INTRINSIC FACTORS

1. Genetics
2. Immunity
3. Age & sex



EXTRINSIC FACTORS

1. Climate change
2. Poverty
3. Nutritional status
4. General health
5. Social conditions
6. Access to treatment

ON THE SKELETONS

- ❑ Infectious diseases = affecting skeletons
- ❑ Useful variation among different infectious diseases (not leading to immediate death) that affect the skeleton in:
- ✓ type of bone lesions
- ✓ distribution of these lesions within the skeleton
- ❑ Recording the presence of **bone abnormalities** is the basis for eventual diagnosis
- ❑ Their distribution & characteristics are used to develop DD

3 TYPES OF NEW BONE FORMATION

1. Woven bone	Mechanically weak, random collagen fabric, porous
gray/green in color	usually pitted or striated


a thick layer of very distinct woven bone

Indicates that the disease process was active at the time of death

3 TYPES OF NEW BONE FORMATION

2. Lamellar bone	Mechanically strong, regular collagen fabric
Same colour as surrounding 'normal' bone	often pitted, striated or irregular in morphology

lamellar bone formation. Note the striated appearance & colour.

Indicates that the disease process was healing at the time of death

3 TYPES OF NEW BONE FORMATION

3. Mixte bone

Mixed of woven & lamellar

tibiae show extensive lamellar and woven new bone formation, indicating a longstanding infection that was also still active at the time of death

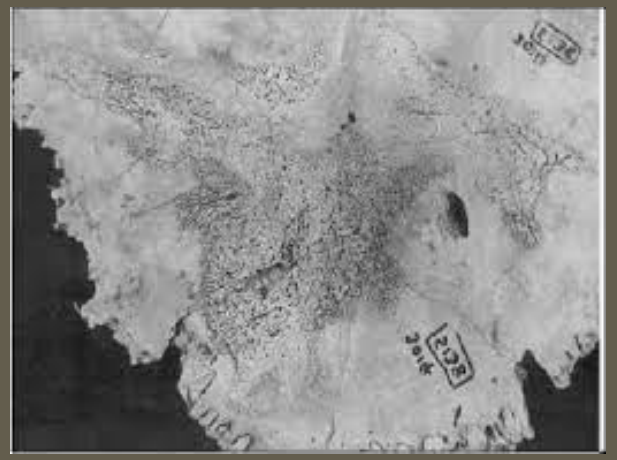
ENDOCRANIAL NEW BONE FORMATION

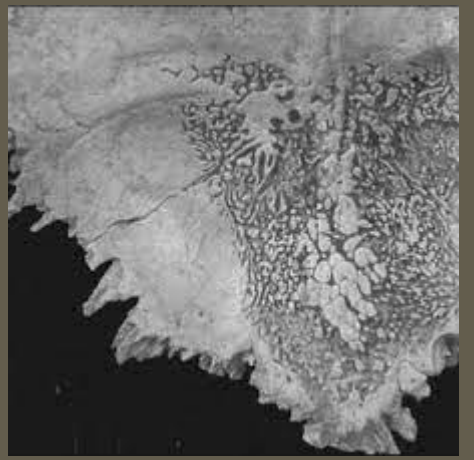
- Reactive new bone on the endocranial
- Diffuse or isolated layers of new bone expanding around meningeal vessels
- 'Capillary' impressions extending into the inner lamina of the cranium
- Schultz (2001)

1. Haemorrhage
2. Inflammation
3. Mix of two

ENDOCRANIAL NEW BONE FORMATION

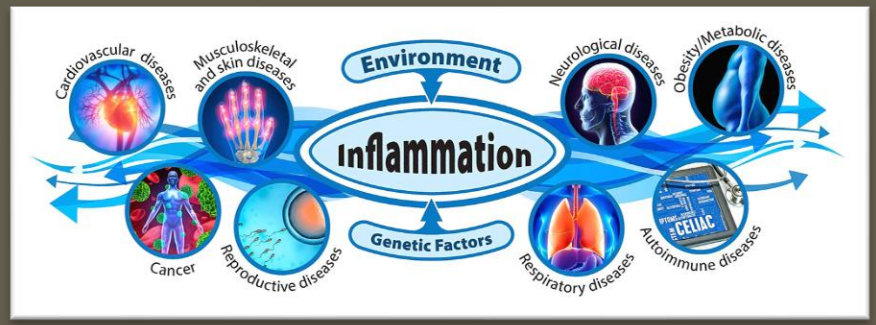
- Result of inflammation or haemorrhageof the meninges
- Differential Diagnosis (DD):
- meningitis, scurvy, trauma, anaemia, rickets, tuberculosis





Lewis 2004

ENDOCRANIAL NEW BONE FORMATION



One of the first immune responses

- Establishes a physical barrier against the spread of infection
- Promotes healing of any damaged tissue

Symptoms: Heat, redness, swelling, pain, loss of function

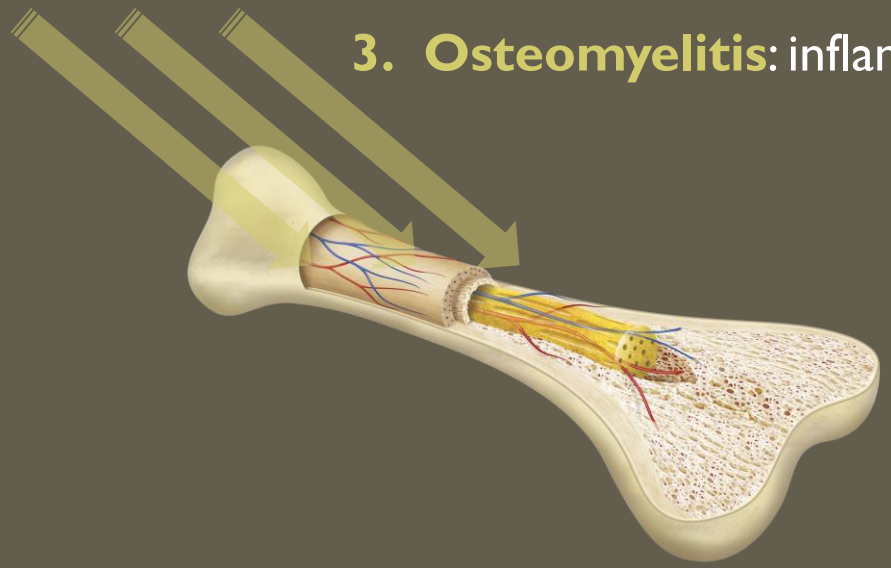
Causes:

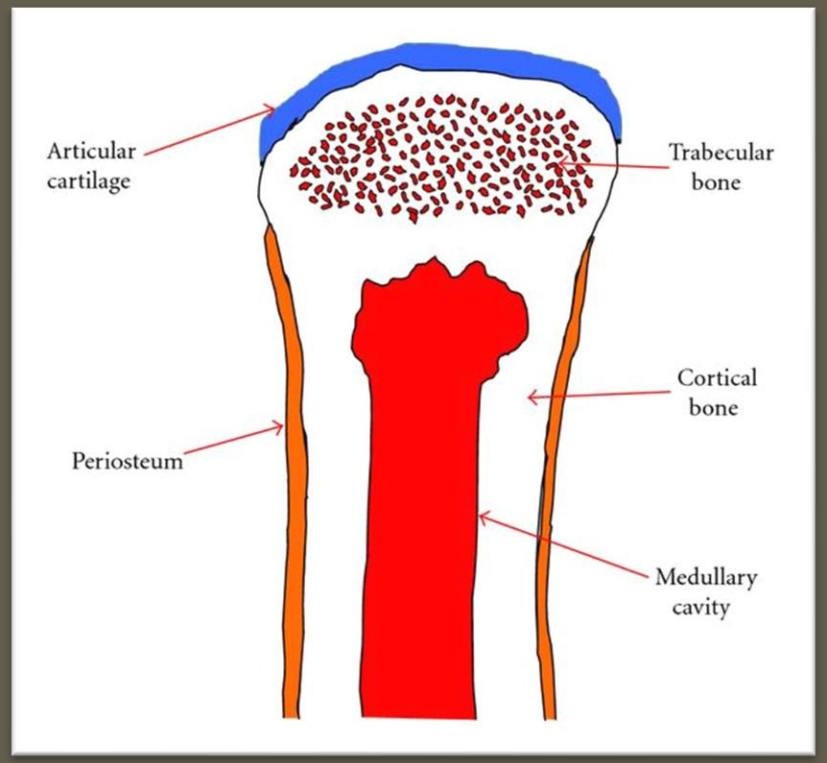
- Microorganisms
- Chemical irritation
- Irradiation
- Trauma
- Heat & cold
- Drug therapies

Inflammation ≠ infection

3 SIGNS OF INFLAMMATION ON BONE

1. **Periostitis**: inflammation of the **periosteum**
2. **Osteitis**: inflammation of the **cortex**
3. **Osteomyelitis**: inflammation of the **medullary cavity**





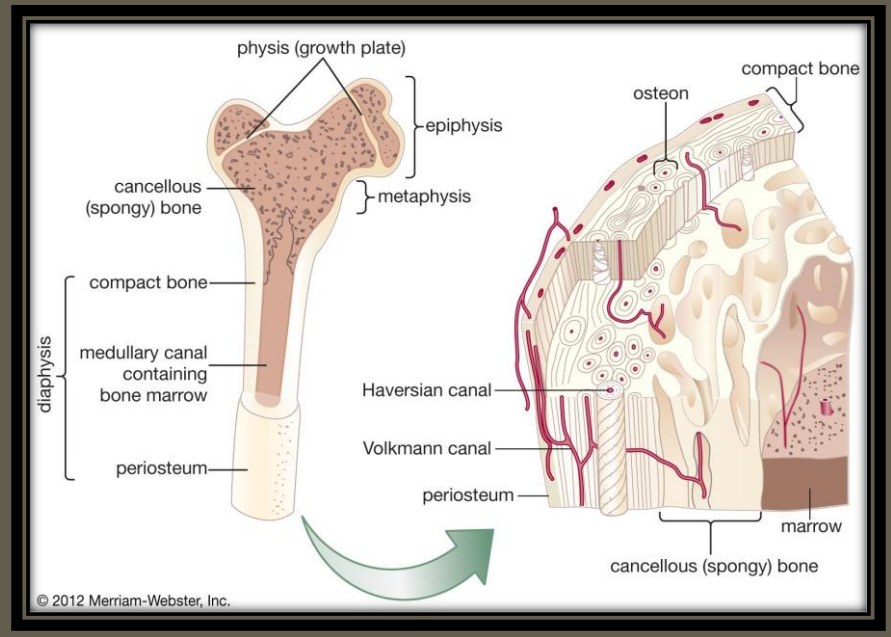
Imaging is necessary to differentiate between periostitis, osteitis & osteomyelitis

1. PERIOSTOSIS

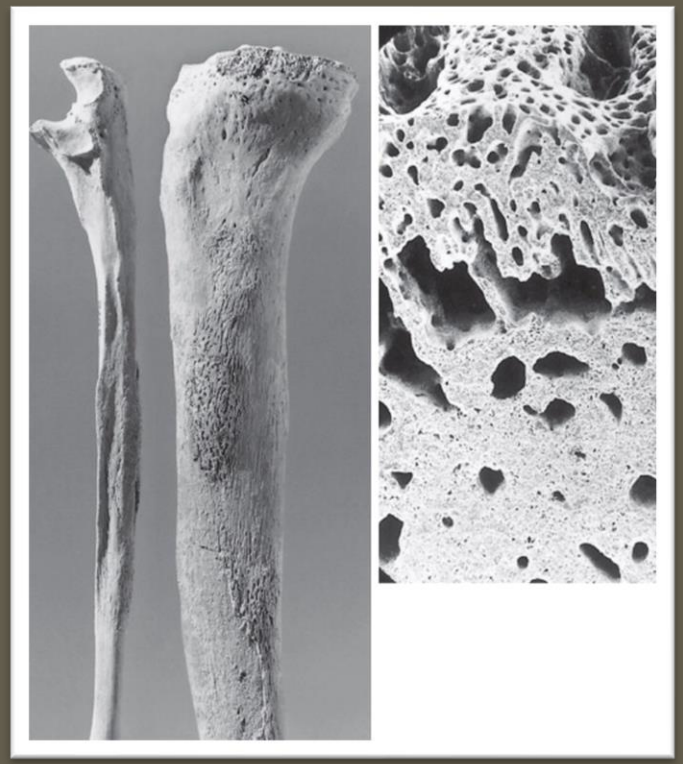
- a reaction to 'damage' to periosteum

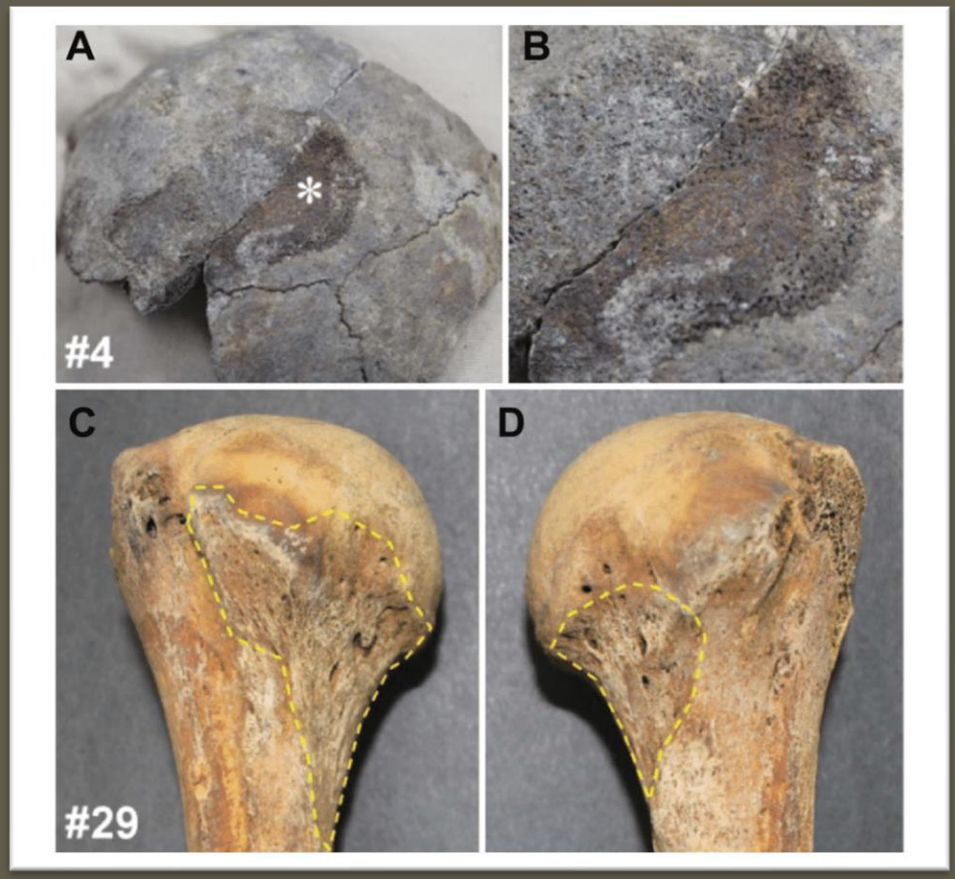
'soft tissue sheath surrounding the bone'

- Succeeding new bone formation
- Periostitis refers to inflammation due to infection only
- Debate if it should used as an **indicator of stress** (Klaus 2014)



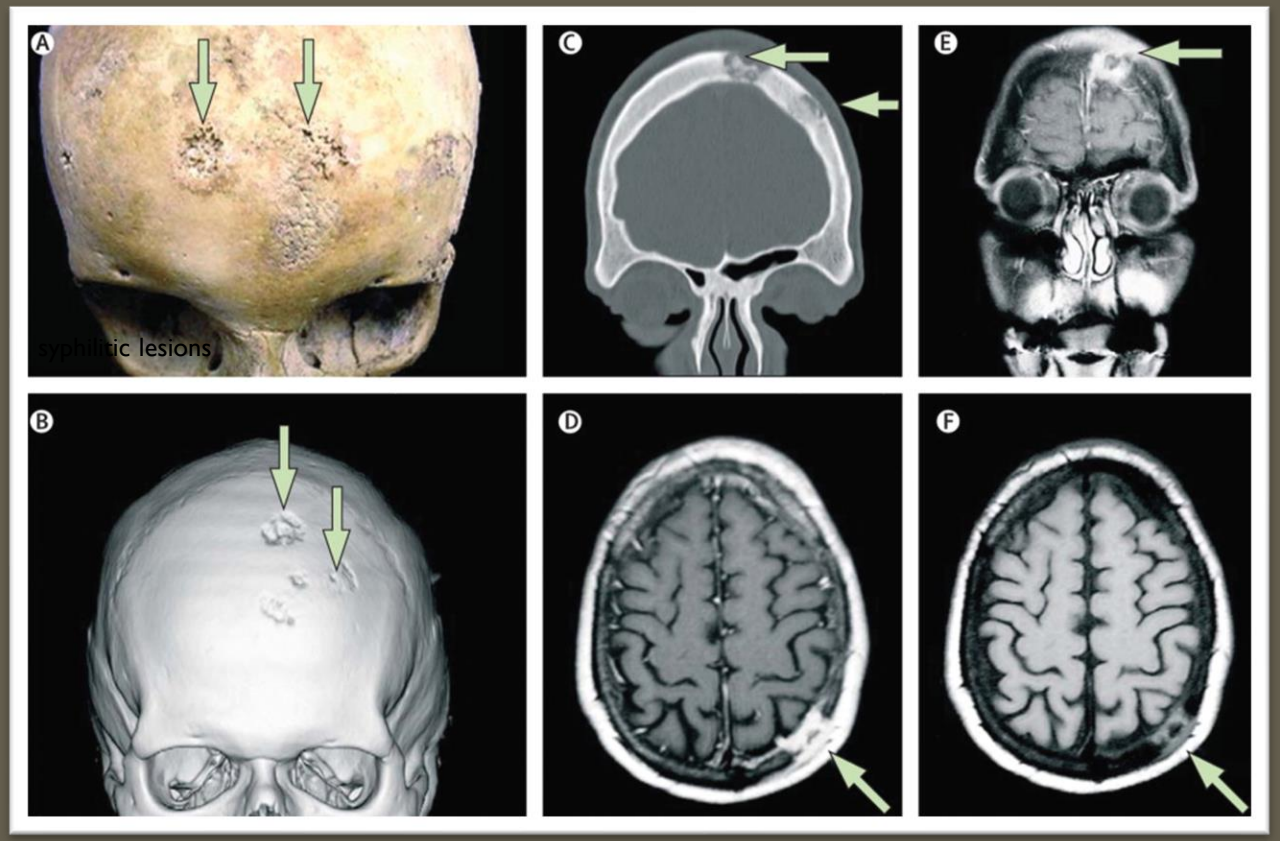
I. PERIOSTOSIS



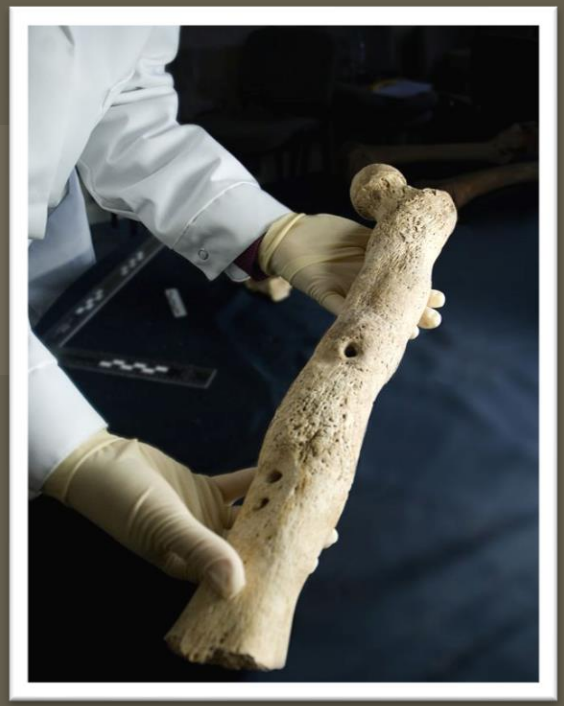


Yi-Suk et al. 2013

2. OSTEITIS



3. OSTEOMYELITIS

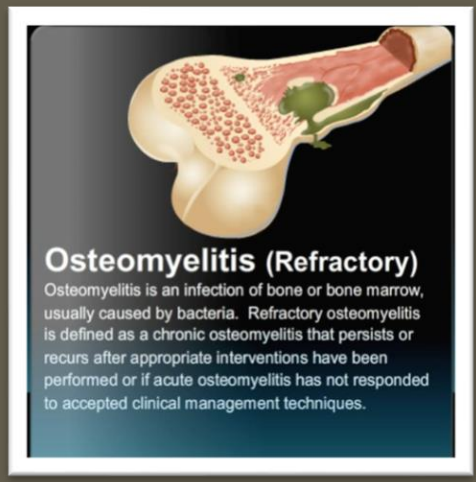


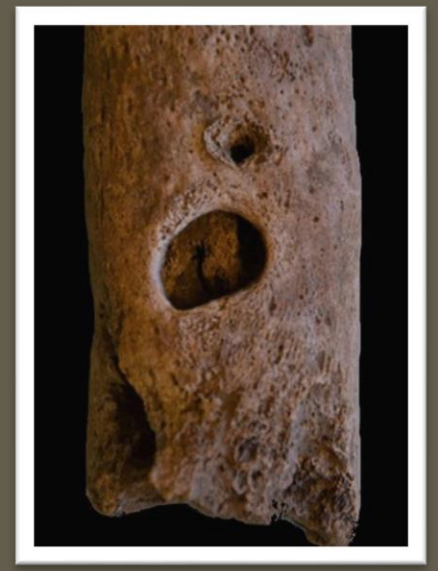
- Acute or chronic
- Caused by pus producing bacteria

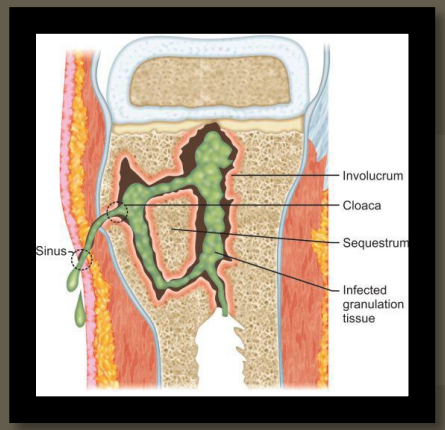
Spread through:

1. Open wound, fracture
2. Contact with infected adjacent tissue
3. Haematogenous(travels through blood)

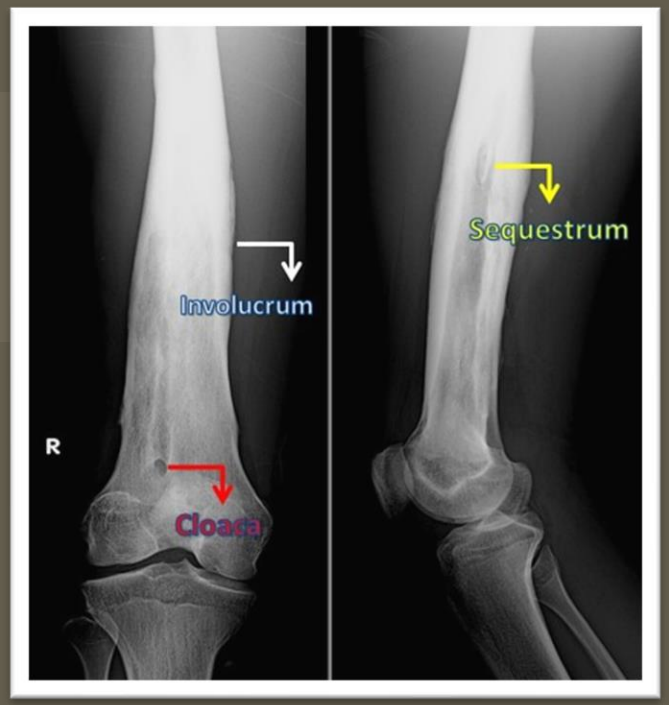
- Prevalence: M>F 4:1
- Femur>tibia> humerus >radius (80% tibia/femur)
- Adults (shafts & ends)
- Children (metaphyses)







3. OSTEOMYELITIS



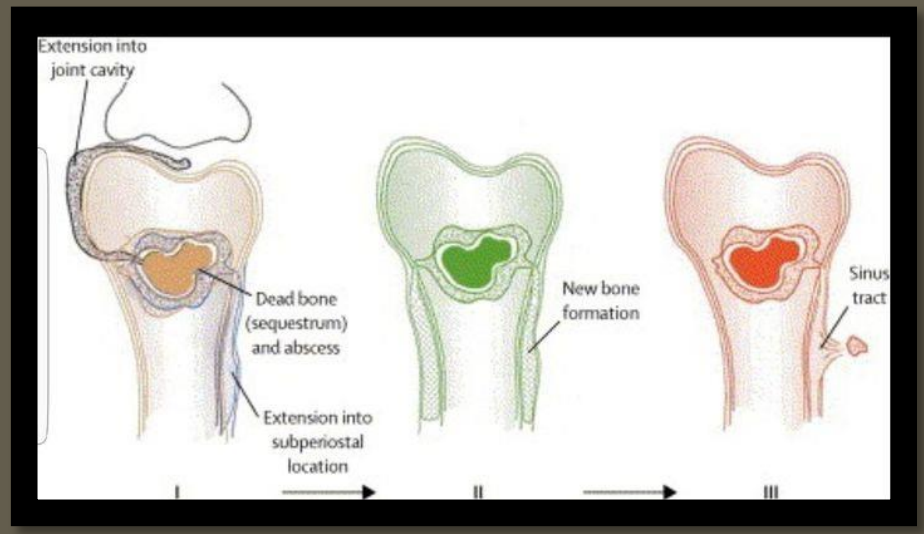
Sequestrum: dead bone surrounded by living bone

Involucrum: bone formed over dead bone

Sinus/cloaca: dead tissue/pus escapes

Other features:

1. Pitting
2. New bone formation-woven or lamellar; smooth, striated or mixed, plaques; blood vessel or nerve impressions
1. Abnormal irregularity
2. Enlargement of the bone



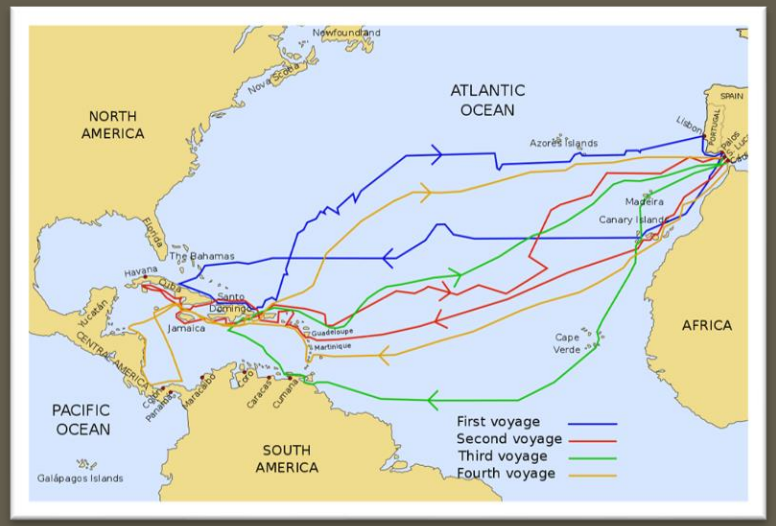
MOST COMMON & STUDIED INFECTIOUS DISEASES

Disease I Syphilis

- Chronic bacterial infection
- Transmitted through sexual contact
- Caused by a type of bacteria known as *Treponema pallidum*

Disease I Syphilis

History



www,wikipedia.com

Continues to be one of the most contentious issues in science' (Ortner 2003)

Different Hypotheses:

1. Columbian theory: a New World disease brought back by Columbus
2. Pre-Columbian theory: present in Europe before the arrival of Europeans in the Americas
3. Combination theory: Present in both Old world and New world pre-Columbus

Disease I Syphilis
Not just Columbus

Syphilis May Have Spread Through Europe Before Columbus

Press release University of Zurich

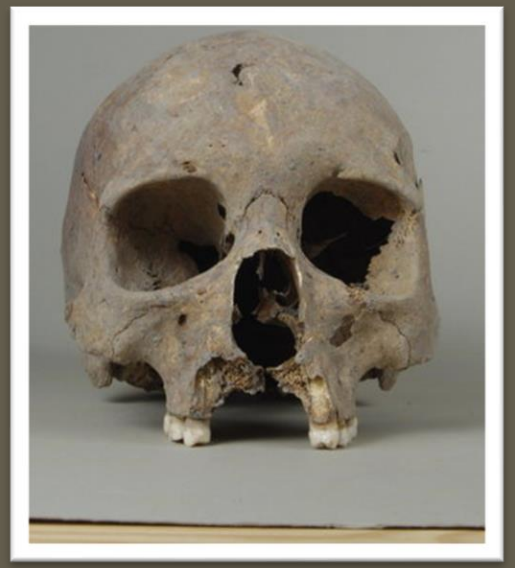
AUGUST 13, 2020

Columbus brought syphilis to Europe – or did he? A recent study conducted at the University of Zurich now indicates that Europeans could already have been infected with this sexually transmitted disease before the 15th century. In addition, researchers have discovered a hitherto unknown pathogen causing a related disease. The predecessor of syphilis and its related diseases could be over 2,500 years old.

Petrous part of the skull of a perinatal infant (PD28) proved an exceptional source for treponemal DNA

Syphilis is a sexually transmitted disease – and while commonly dismissed due to the availability of modern treatments, it is in fact spreading at an alarming rate: Over the last decades, more than 10 million people around the world have been infected with the syphilis subspecies *pallidum* of the *Treponema pallidum* bacteria. Other treponematoses, such as yaws and bejel, are caused by other subspecies of *Treponema pallidum*. The origins of syphilis, which wreaked havoc in Europe from the late 15th to the 18th century, are still unclear. The most popular hypothesis so far holds Christopher Columbus and his sailors liable for bringing the disease to Europe from the New World.

Yaws already widespread in Europe



Lesions in the skull of a Finnish individual showed signs of treponemal infection © Kati Salo

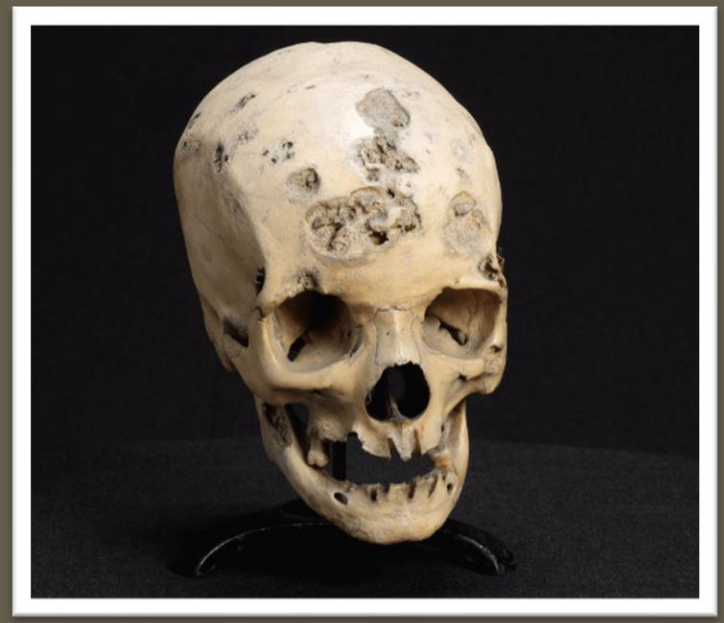
Disease I Syphilis

Skeletal manifestations

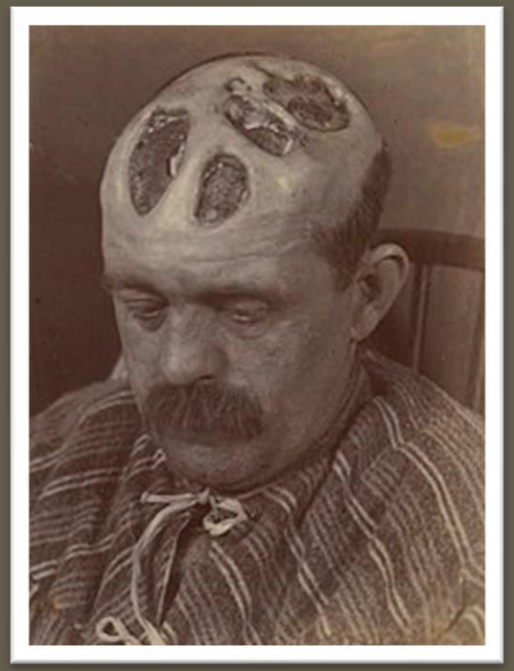
75% of changes found in nasal, vault and tibia/fibula bones

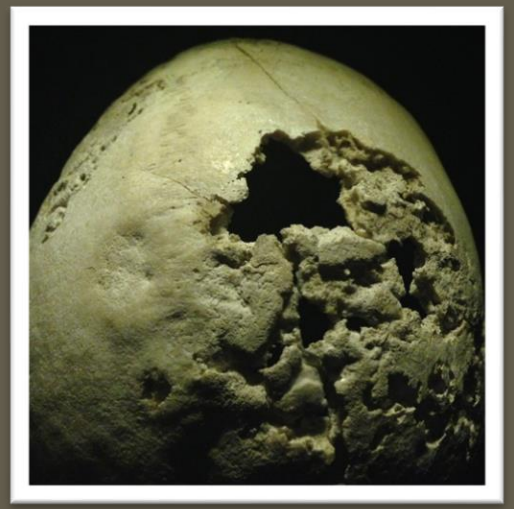
Cranial vault:

- caries sicca (characteristic)
- clustered pits
- bone destruction (gumma)
- bone formation around gumma
- outer table, frontal bone first



© Mutter Museum





Disease I Syphilis

Skeletal manifestations

Post-cranial:

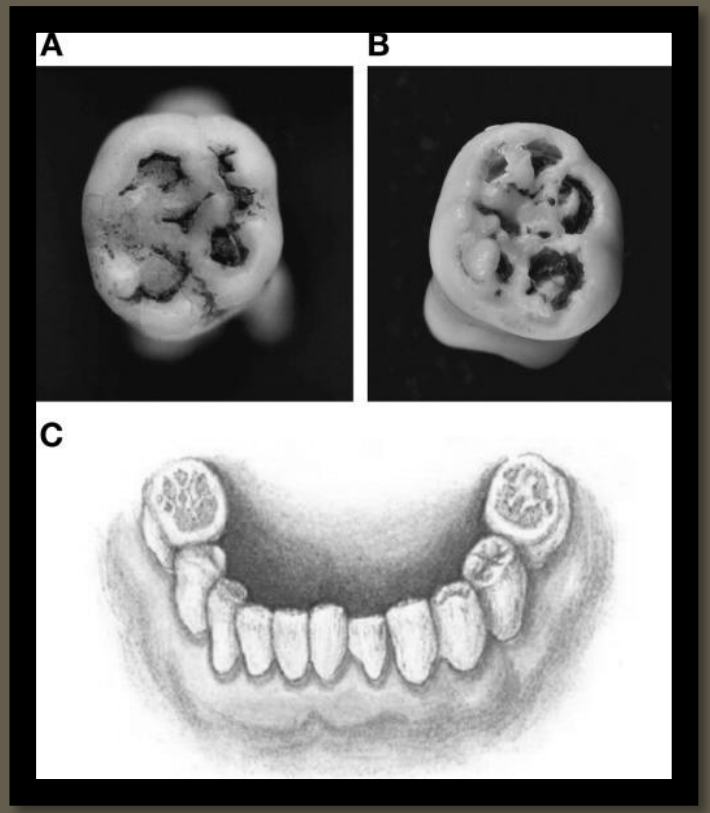
Lower leg bones-destruction/formation of bone; periostitis, osteitis, osteomyelitis (non-gummatous)

- Charcot joints (neurological damage)
- Aortic aneurysm (weakness in blood vessel that erodes spine)?

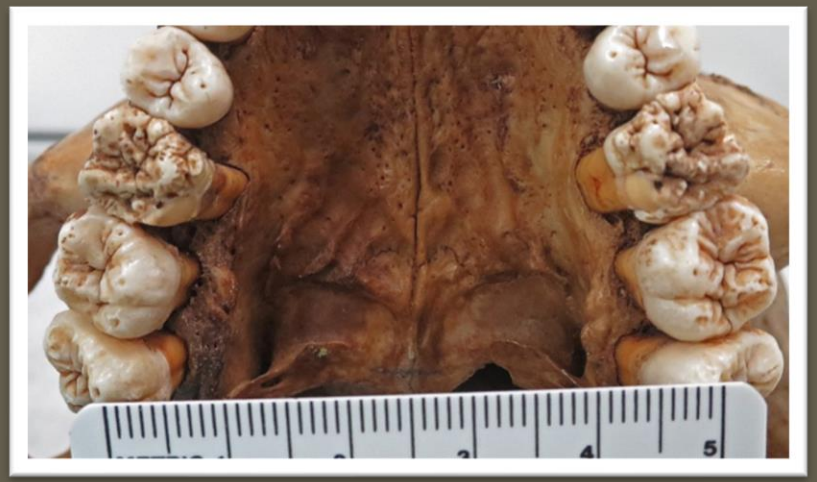
Disease I Syphilis
Congenital

Dental defects:

1. Hutchinson's incisors
2. Mulberry molars
3. Moon/Fournier molars

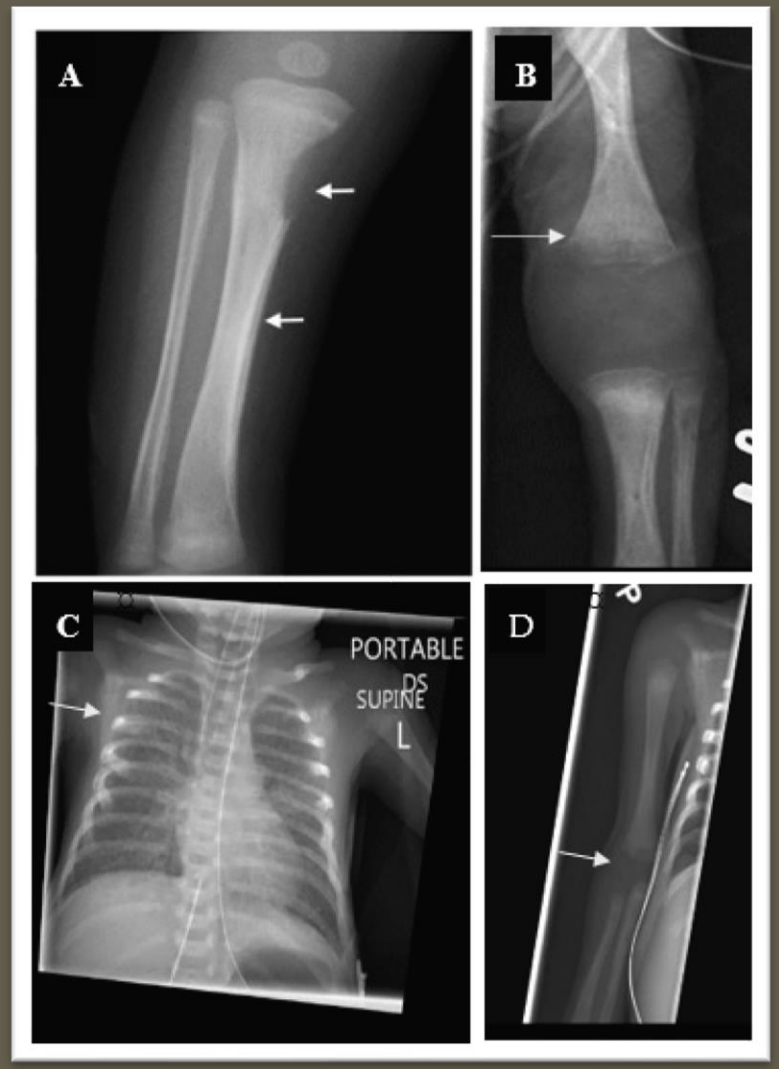


Henneberg 2018



Disease I Syphilis
Congenital

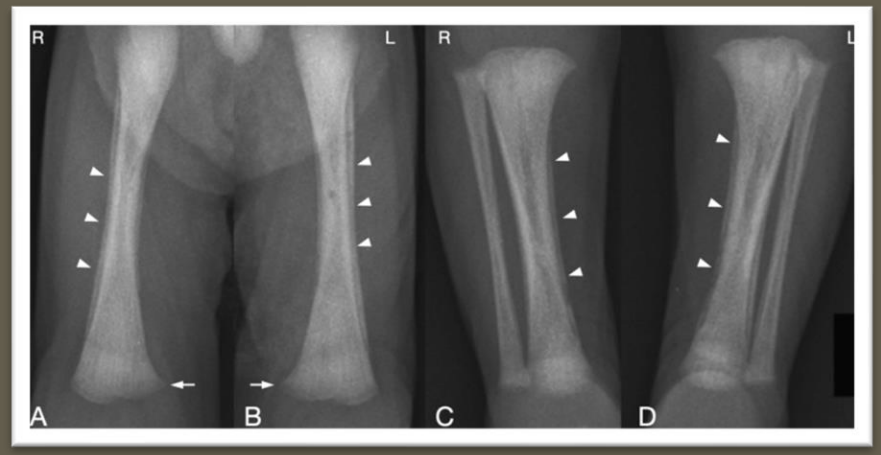
- A chronic infectious disease
- Caused by a spirochete (treponema pallidum)
- Acquired by the fetus in the uterus before birth
- 80% From the mother
- High mortaility, No treatment
- Symptoms after several weeks, months or years after birth



Disease I Syphilis
Congenital

Skeletal manifestations:

1. Periostitis-distal femur/proximal tibia
2. Osteitis
3. Osteomyelitis
4. Osteochondritis
5. Wimberger'ssign (medial tibial metaphyseal loss)
6. Dactylitis

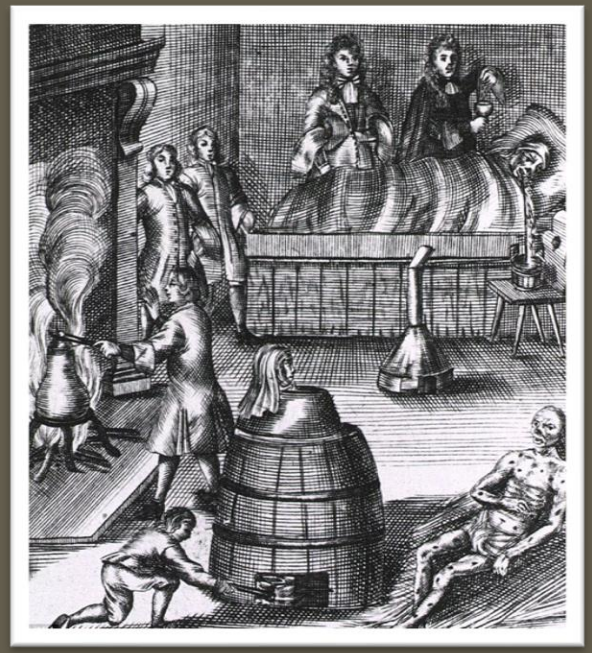


Disease I Syphilis
Historical Treatment

- No effective treatments but a number of remedies

- Expel the foreign, disease-causing substance from the body:

(blood-letting, laxative use, and baths in wine and herbs or olive oil)



www.history.com

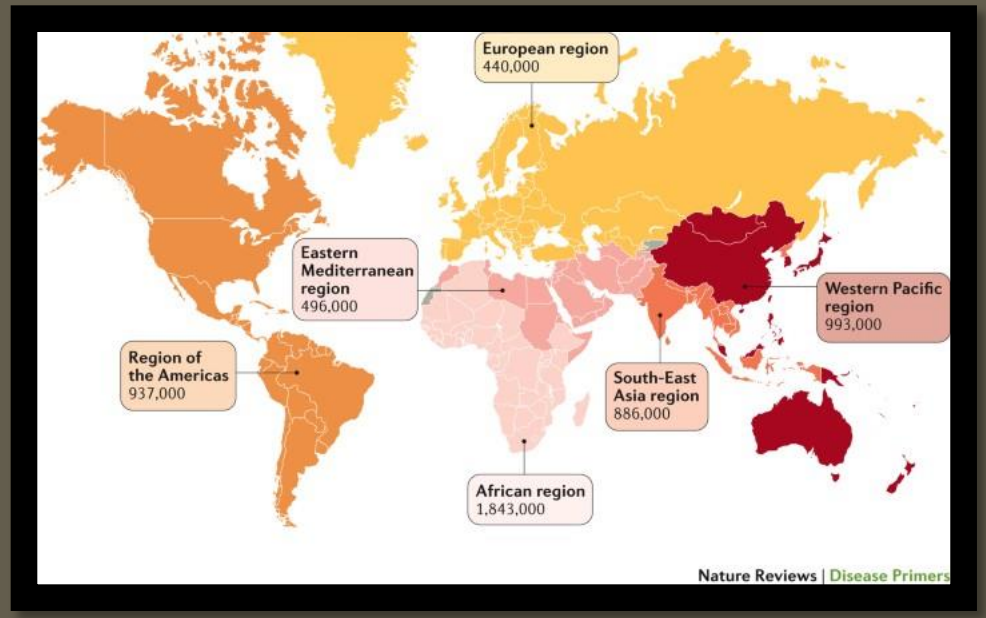
- Use of mercury during the16th cent:

1. rubbing it on the skin
2. applying a plaster
3. by mouth
4. 'Fumigation' method

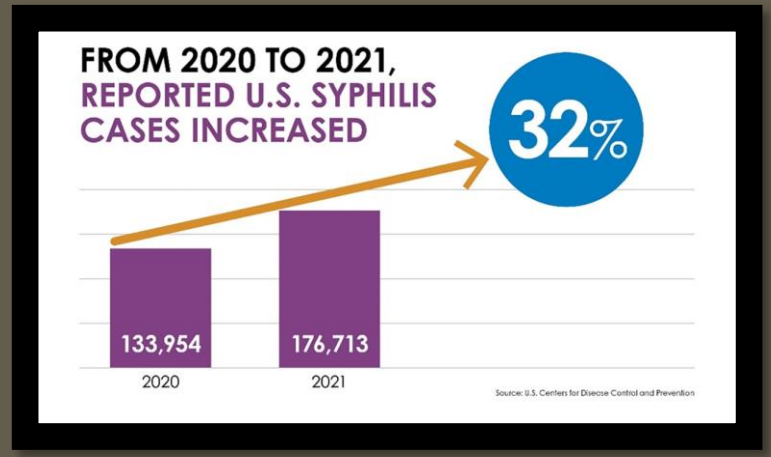
Disease I Syphilis

Today

1. Most infections are asymptomatic or unrecognized.
2. WHO estimates that 7.1 million adults between 15 and 49 years old acquired syphilis in 2020.
3. Syphilis in pregnancy, when not treated, treated late or treated with the incorrect antibiotic, results in 50−80% of cases with adverse birth outcomes.
4. Key populations such as gay men and other men who have sex with men are disproportionately affected.

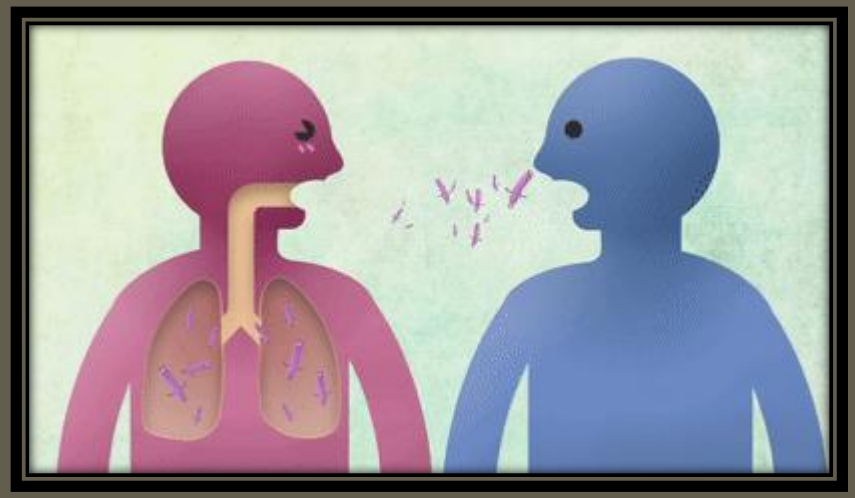


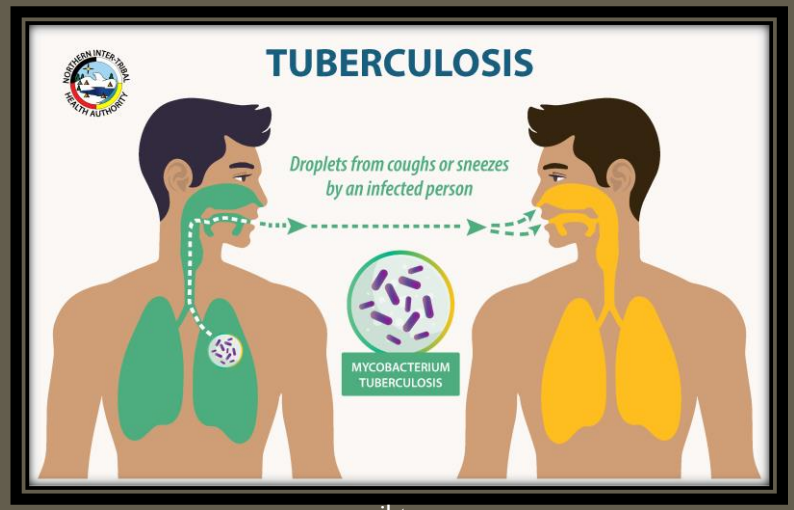
www.nih.gov



Disease II: Tuberculosis

- Bacterial infection spread through inhaling tiny droplets from the coughs or sneezes of an infected person
- Mainly affects the lungs
- But can also affect any part of the body (abdomen, glands, nervous system and **bones**)





www.nihta.com

Disease II Tuberculosis

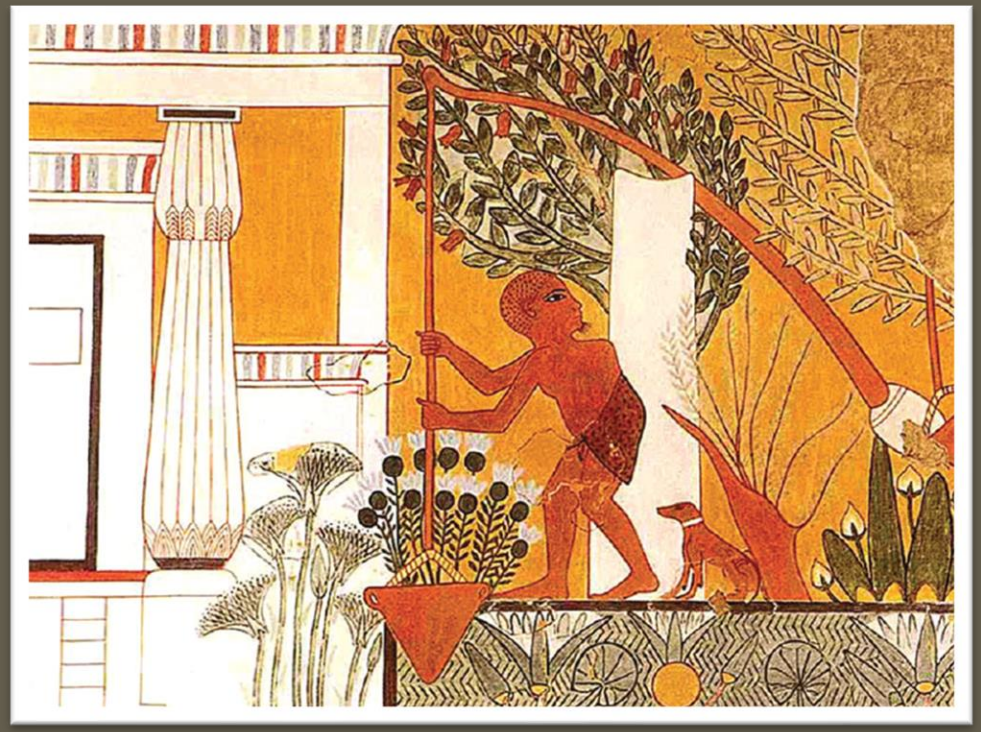
Ancient Time

Egypt

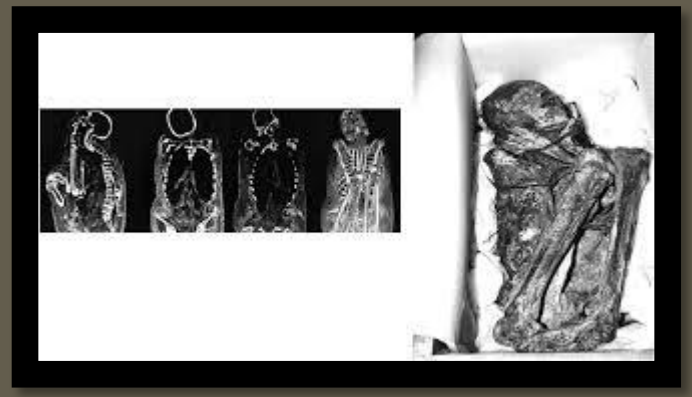
mummies 2400BC: skeletal deformities typical of tuberculosis

early art (tombs drawings & sculptures of hunchback): Pott's lesions

no evidence about TB lesions in Egyptian papyri



Egyptian painting depicting a man afflicted with Pott's disease of the spine



Disease II Tuberculosis

Ancient Time

India

1st written documents 1500BC, later 500BC number of Sanskrit manuscript

Andean region

Peruvian mummies : early TB, Pott's deformities → disease was present before the colonization of the 1st European pioneers in South America

Nasca Boy's remains, © National Museum of Ica, Peru.

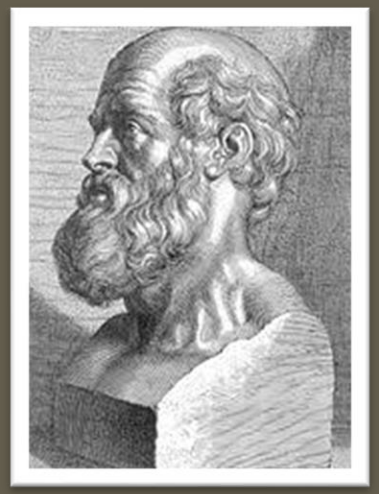
Rigveda manuscript, 19th century, India

Disease II Tuberculosis

Ancient Time

Ancient Greece

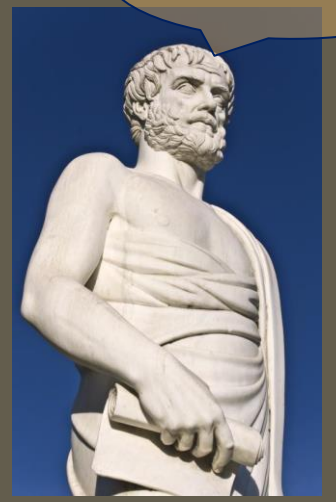
Well known & called Phtisis



a fatal disease for young adults, accurately defining its symptoms & the characteristic tubercespeciallyular lung lesions

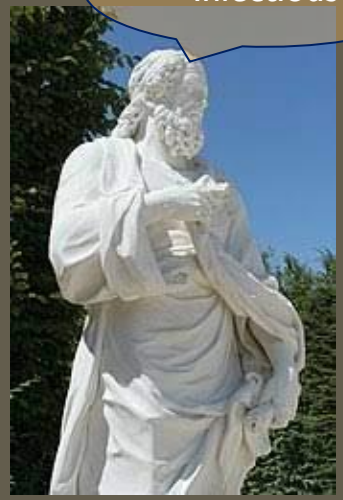
Hippocrates

Contagious



Aristotle

Infectious



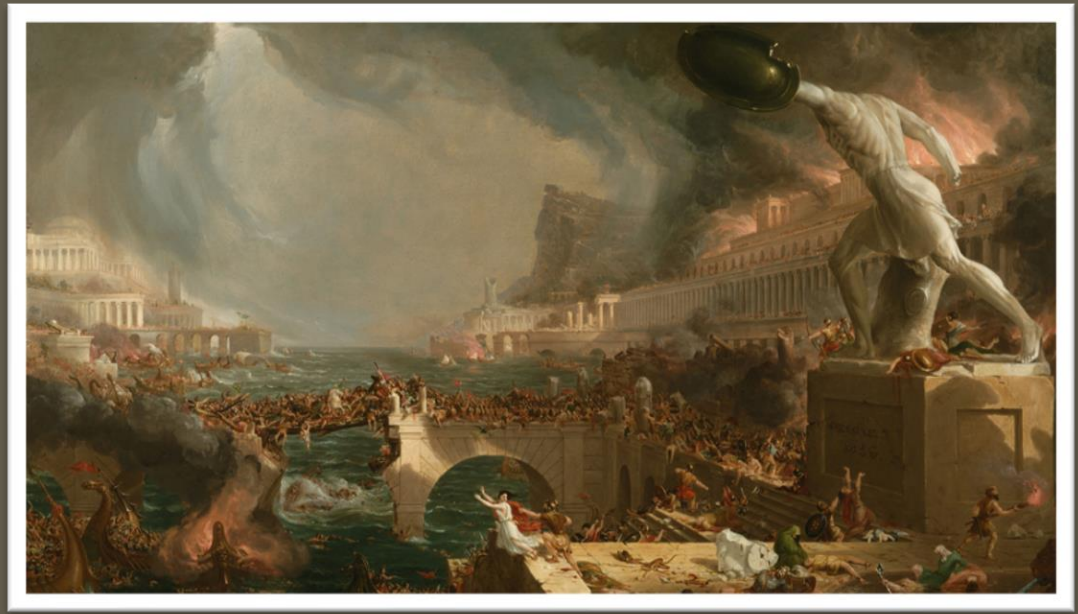
Isocrates

Disease II Tuberculosis
Ancient Time

After the decline of the Roman Empire,

TB widespread in Europe in the XVIII & XIX centuries

witnessed by several archaeological findings



© Adams 2018

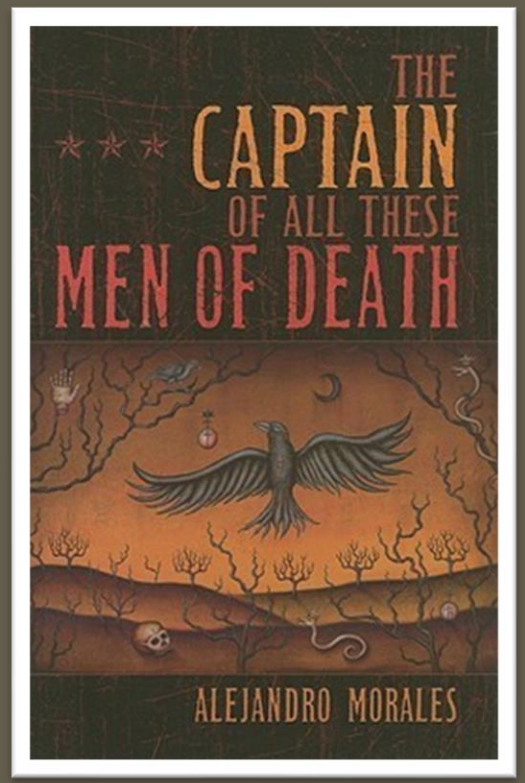
Disease II Tuberculosis

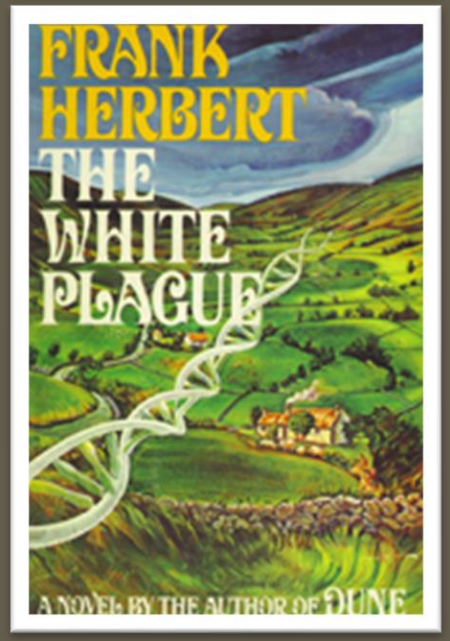
king's evil

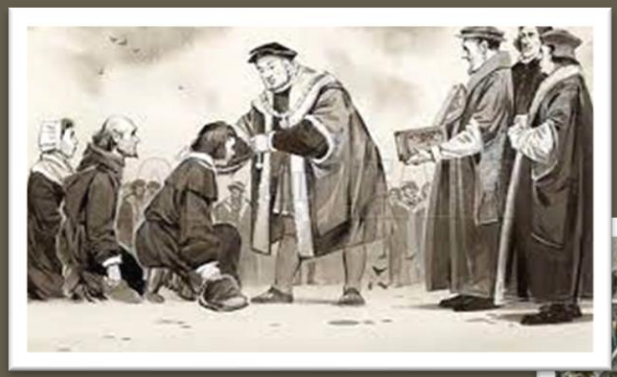
The robber of youth

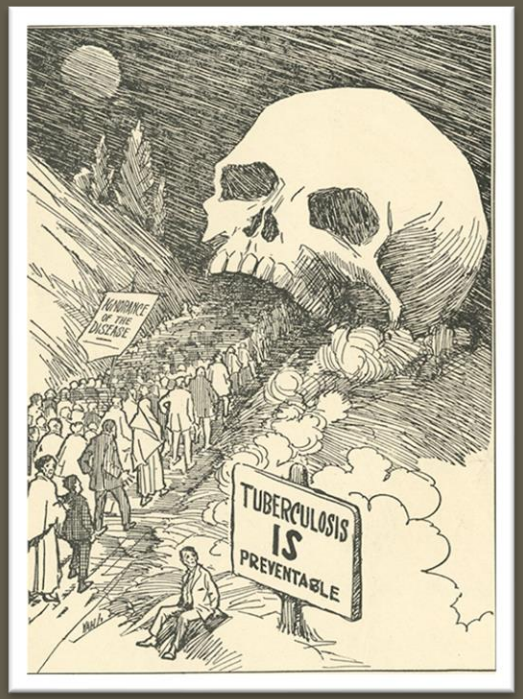
White plague

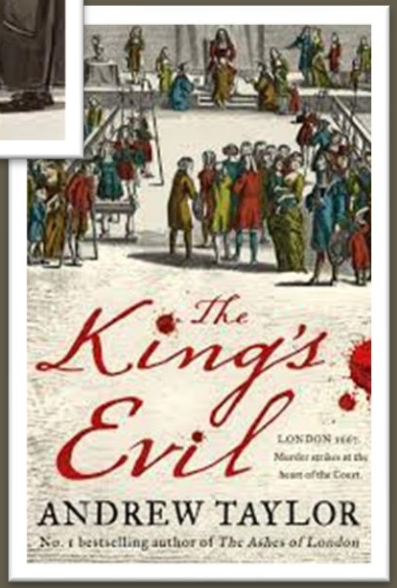
Captain of all these men of death











Disease II Tuberculosis

Origin

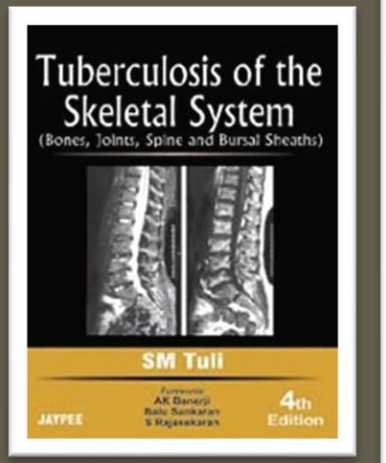
- Transmission to/from domesticated animals
- TB also occurs in wild and feral animals (badgers, cats, fallow deer, horses, bison etc.)
- Transmission due to sharing of same living environment (e.g. Sharing of house with cattle in winter)
- Consumption of dairy products from infected animals
- Use of dung from infected animals as fuel

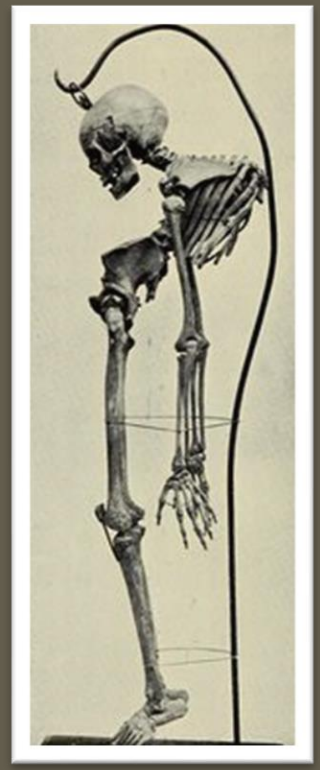
https://commons.wikimedia.org

TB has human, not animal, origins
The origins of human TB have been traced back to hunter-gatherer groups in Africa 70,000 years ago

Disease II Tuberculosis

Skeletal Manifestations





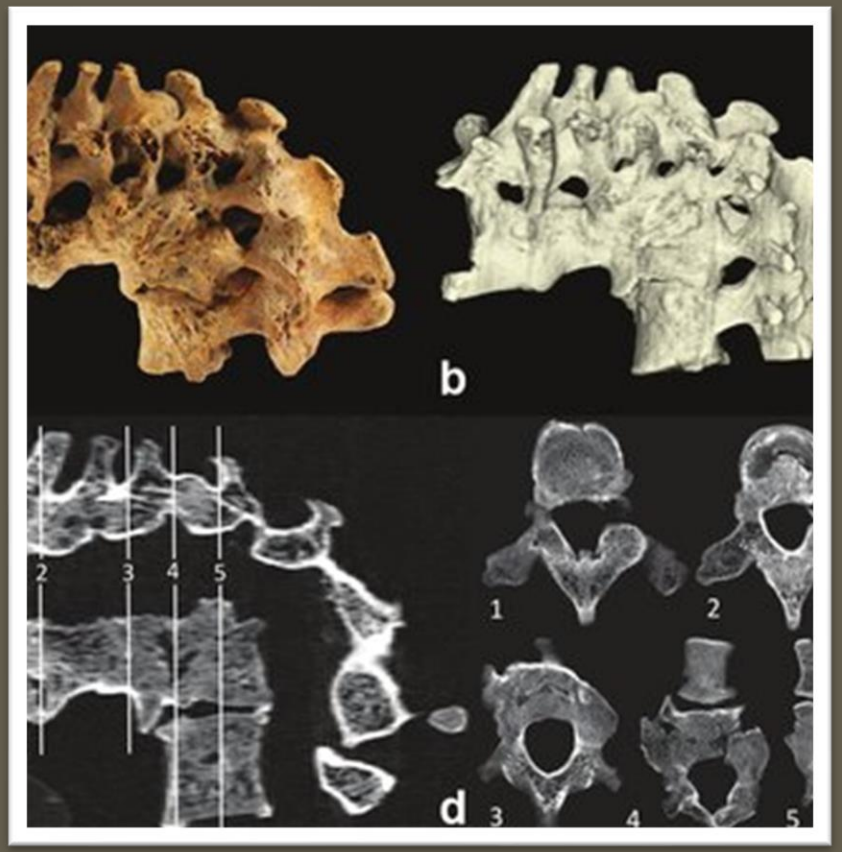
in ca. 3-5% of cases:

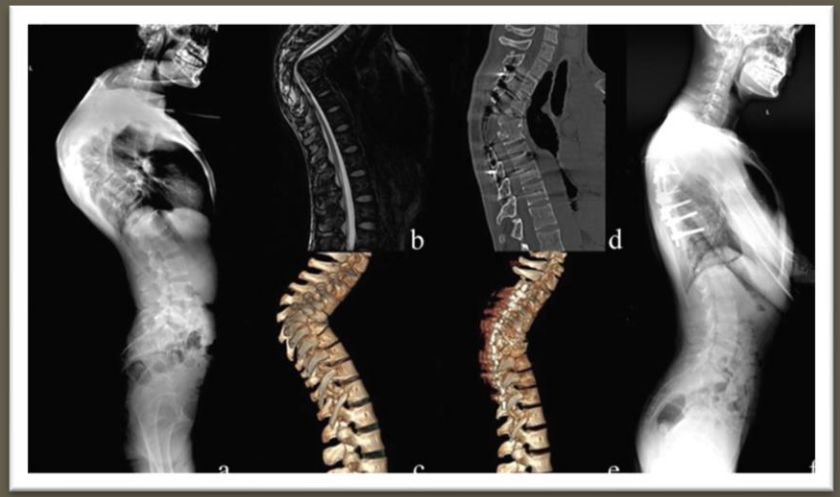
- Spine > hip > knee
- Rib lesions and calcified pleura
- HPOA-hypertrophic pulmonary osteoarthropathy
- Fingers/toes → spina ventosa/dactylitis

Disease II Tuberculosis

Spinal Deformities

- Hallmark feature of spinal tuberculosis
- Especially lower thoracic and lumbar vertebrae
- 1-4 vertebrae
- Collapse →kyphosis (Pott's disease)
- Neural arches rarely involved
- Affect central part, paradiscal & anterior focus





Disease II Tuberculosis
Joints

Weight-bearing joints
- Hip
- Loss of femoral head

Unilateral like in septic (pyogenic) arthritis
- Septic arthritis often leads to fusion of joint, rare in TB

Disease II Tuberculosis
But Not Only

Other diagnostic criteria of TB could include:

- New bone formation on visceral aspect of ribs
- Psoas abscess

Debate: correlation between rib lesions & TB infection

- Calcified pleura

No ultimate proof

Even if aDNA can be amplified, does not prove that lesions were caused by TB

Journal of Medical Case Reports

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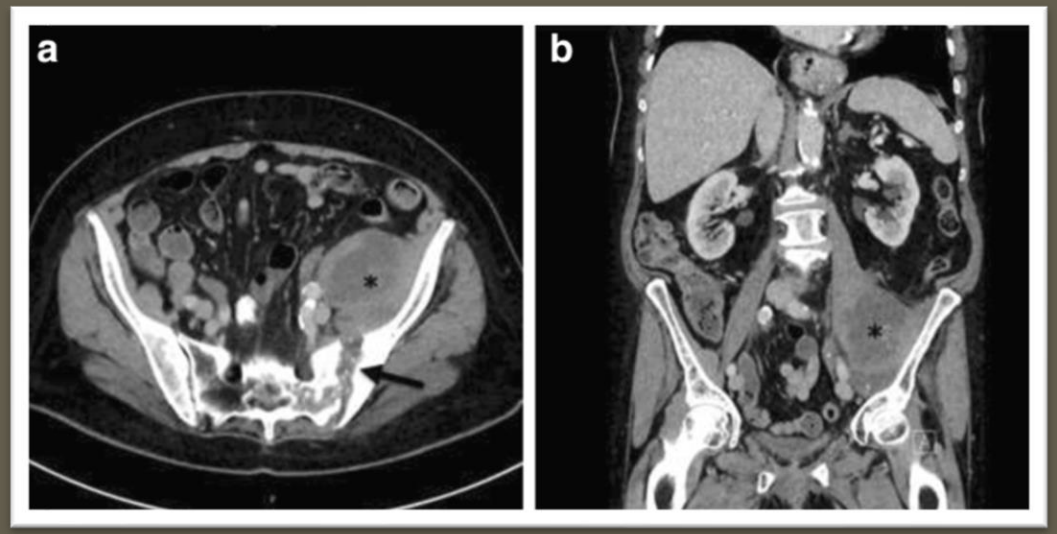
Case report | Open Access | Published: 18 August 2018

Tuberculous sacroiliitis with secondary psoas abscess in an older patient: a case report

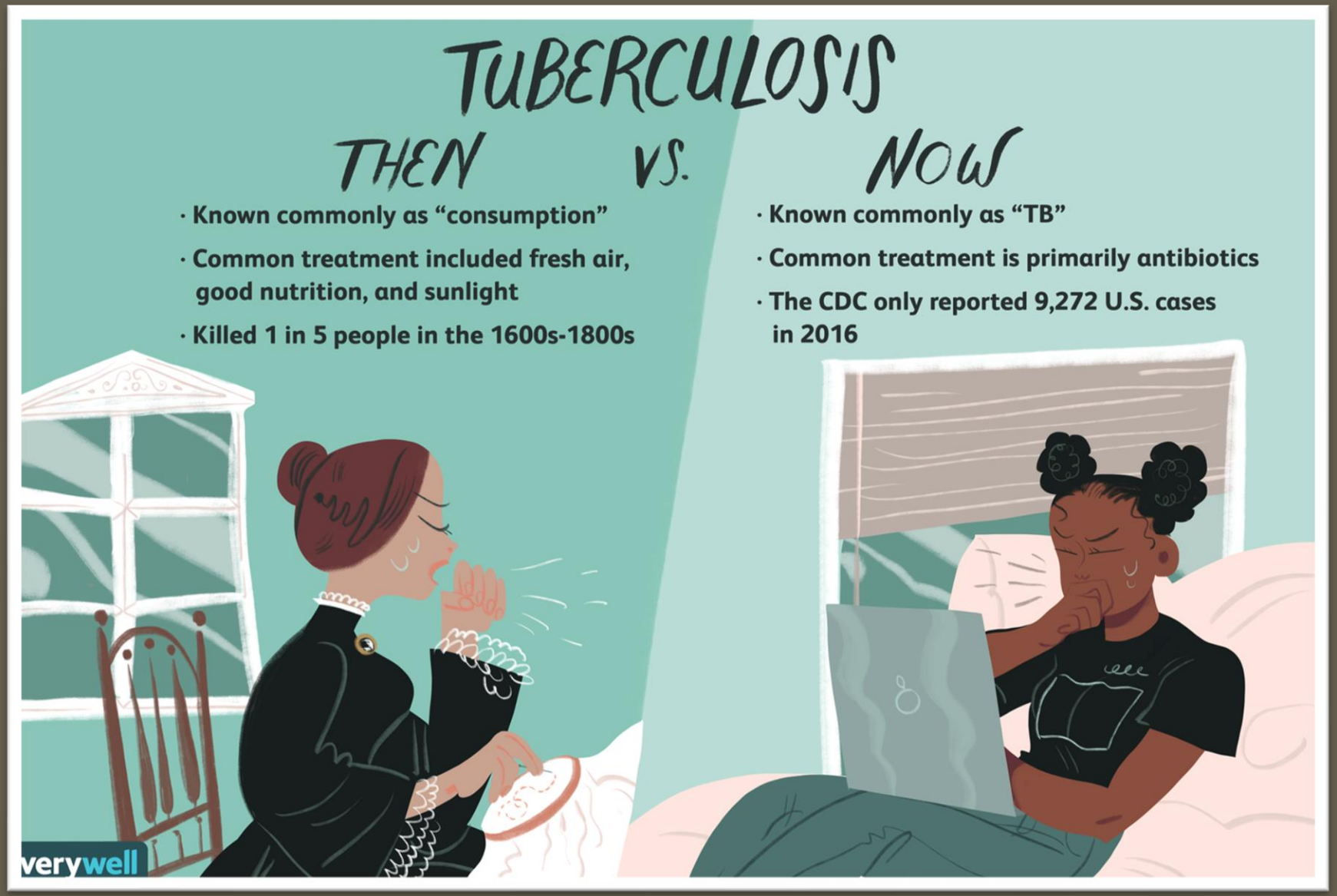
Luisa Kramer, Vanessa Geib, John Evison, Ekkehardt Altpeter, Jasmin Basedow & Jan Brügger

Journal of Medical Case Reports **12**, Article number: 237 (2018) | Cite this article

3742 Accesses | **6** Citations | **1** Altmetric | Metrics



Abdominal computed tomography images showing left psoas abscess (*star*) and destruction of the sacroiliac joint (*arrow*). **a** Coronal image; **b** axial image

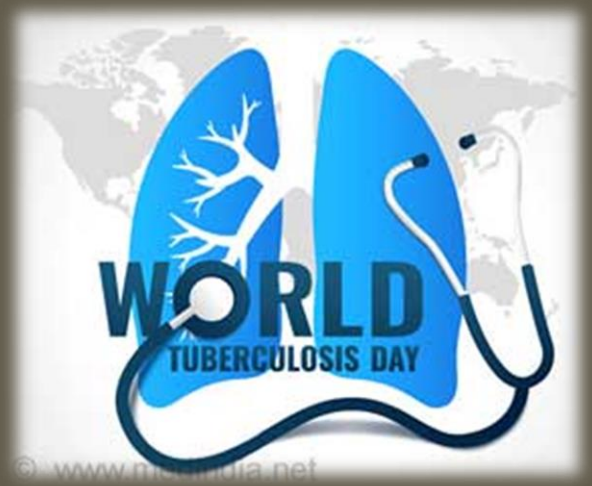


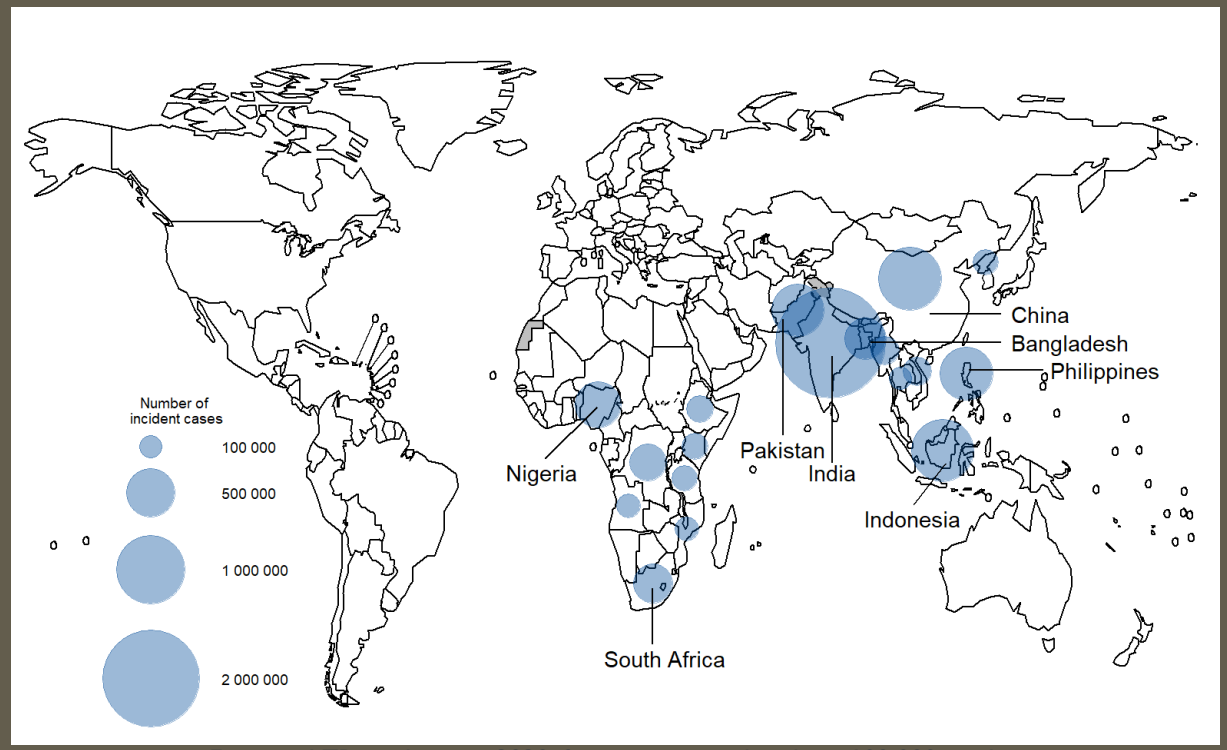
www.verywellhealth.com

Disease II Tuberculosis

Today

- Most frequently encountered mycobacterial disease in the world
- Annually 1.8 million people die from TB





Estimated TB incidence in 2020, for countries with at least 100 000 incident cases

Antonio-Arques et al. 2021

Nowadays TB is still a major public health problem, for this reason a combined strategy, based on improving drug treatment, diagnostic instruments, and prevention strategy, is necessary, in order to eradicate *Tuberculosis* by the year 2050, as committed by the World Health Organization (WHO)

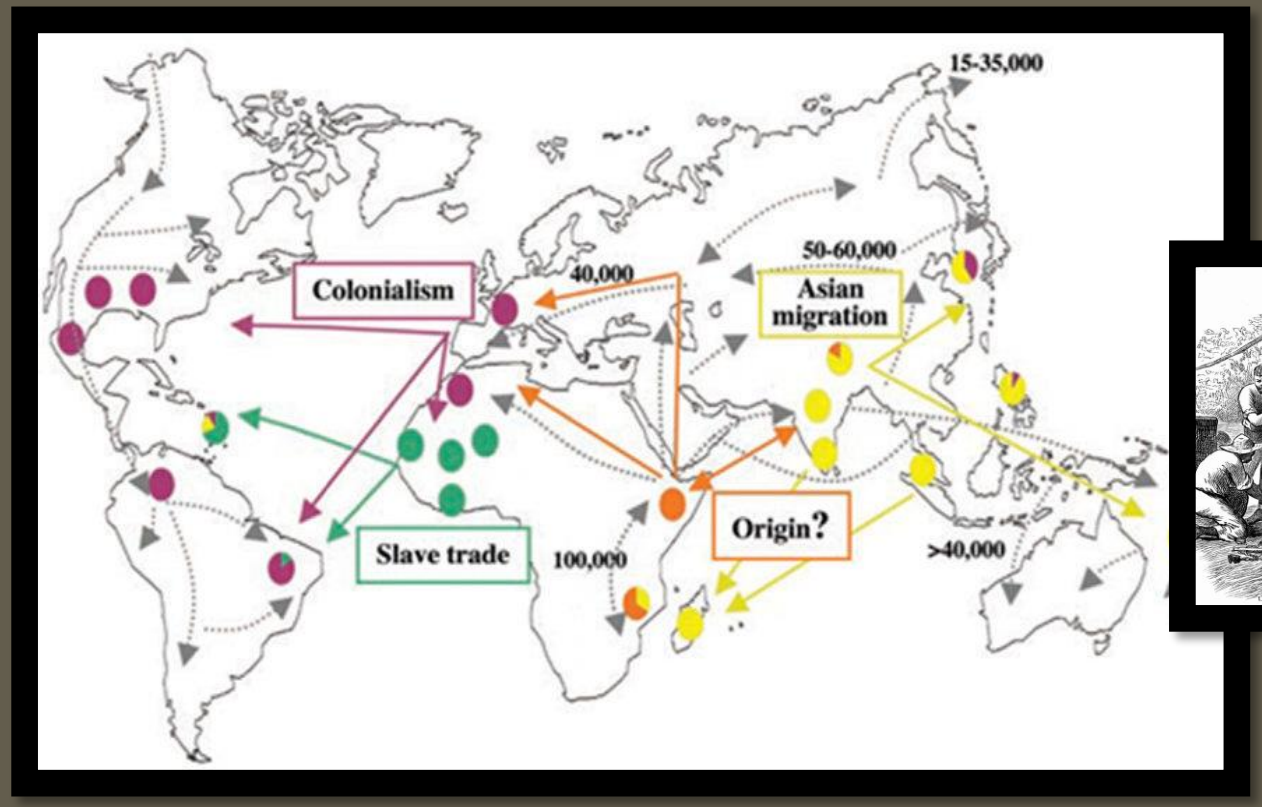
Disease III Leprosy (hansen's disease)

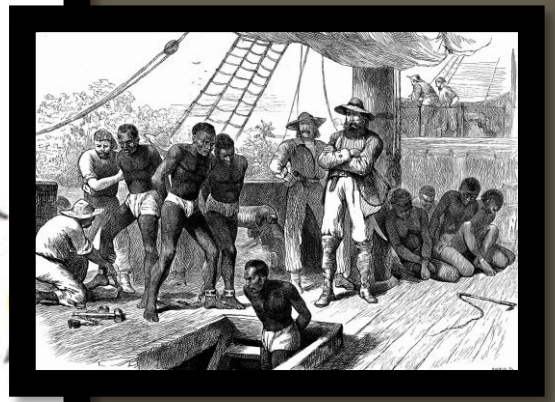
- Infection caused by slow-growing bacteria called Mycobacterium leprae
- Can affect the nerves, skin, eyes, and lining of the nose (nasal mucosa)
- Often acquired in childhood
- M>F
- Incubation period 2-5 yrs (10-20 yrs)
- Slowly progressing

Disease III Leprosy

Around the world

- Origin in East Africa or Near East 100,000 years ago

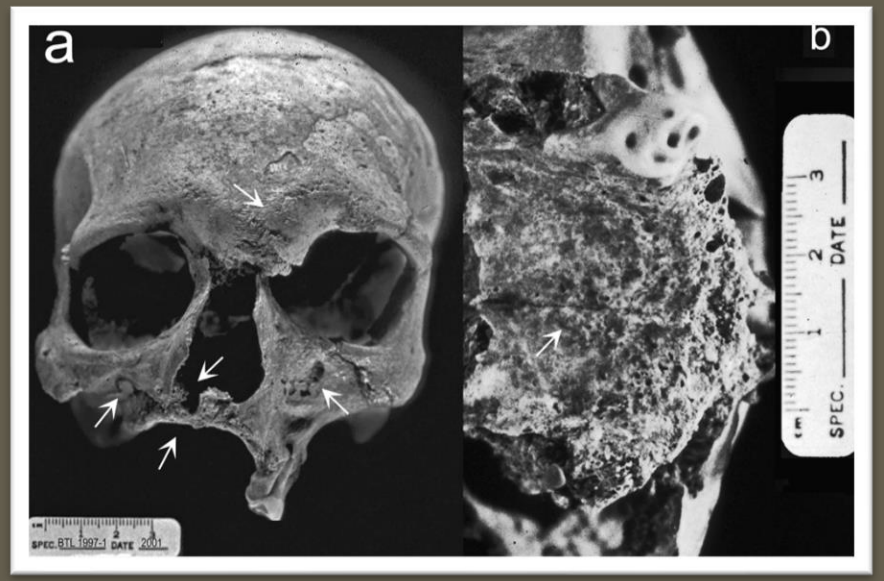




Disease III Leprosy

Ancient Times

- **Near East**
  - Skeletons 3000 BCE (Nubia, Anatolia)
- **India**
  - Skeletons 2000 BCE
  - Written documents evidence 600 BCE
- **China**
  - Written documents300 BCE
- **Europe**
  - Skeletons 4000-3000 BCE
  - Sculptures from medieval times
  - Most burials from the late medieval period



India. Robbins et al. 2009

Disease III Leprosy
Origin

- **Non-human primates**
  1. Chimpanzees
  2. Cynomolgus macaques
  3. Sooty mangabey monkey

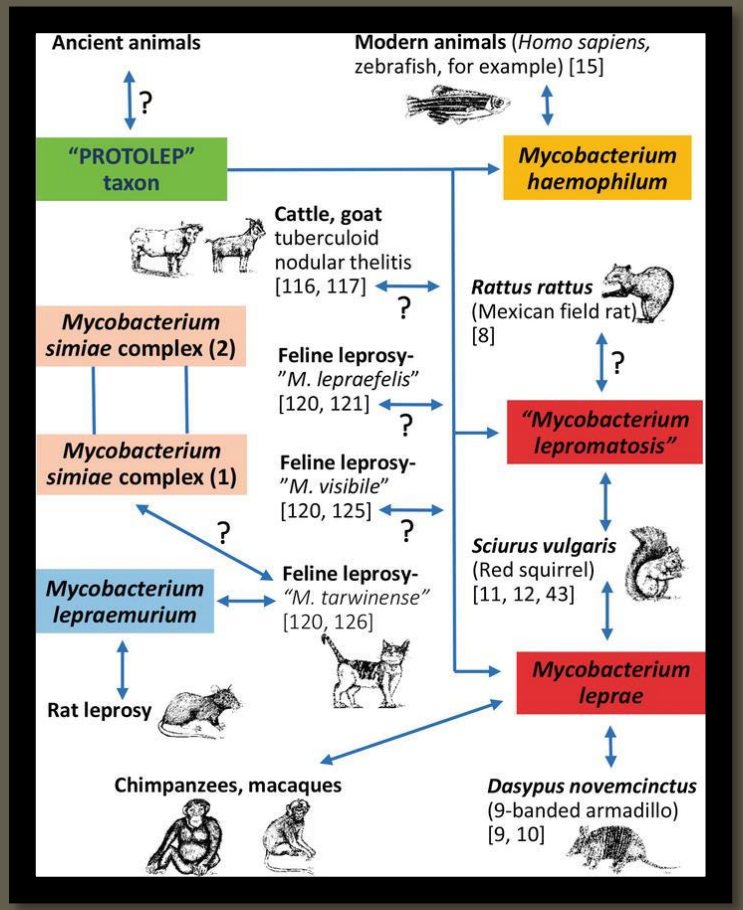
Disease III Leprosy
Origin

American continents,

- has been transmitted to humans through infected armadillos (9 banded armadillos)

UK

- red squirrel population has been known to develop leprosy, but no transmission from squirrel to human.



Disease III Leprosy

Risk Factors

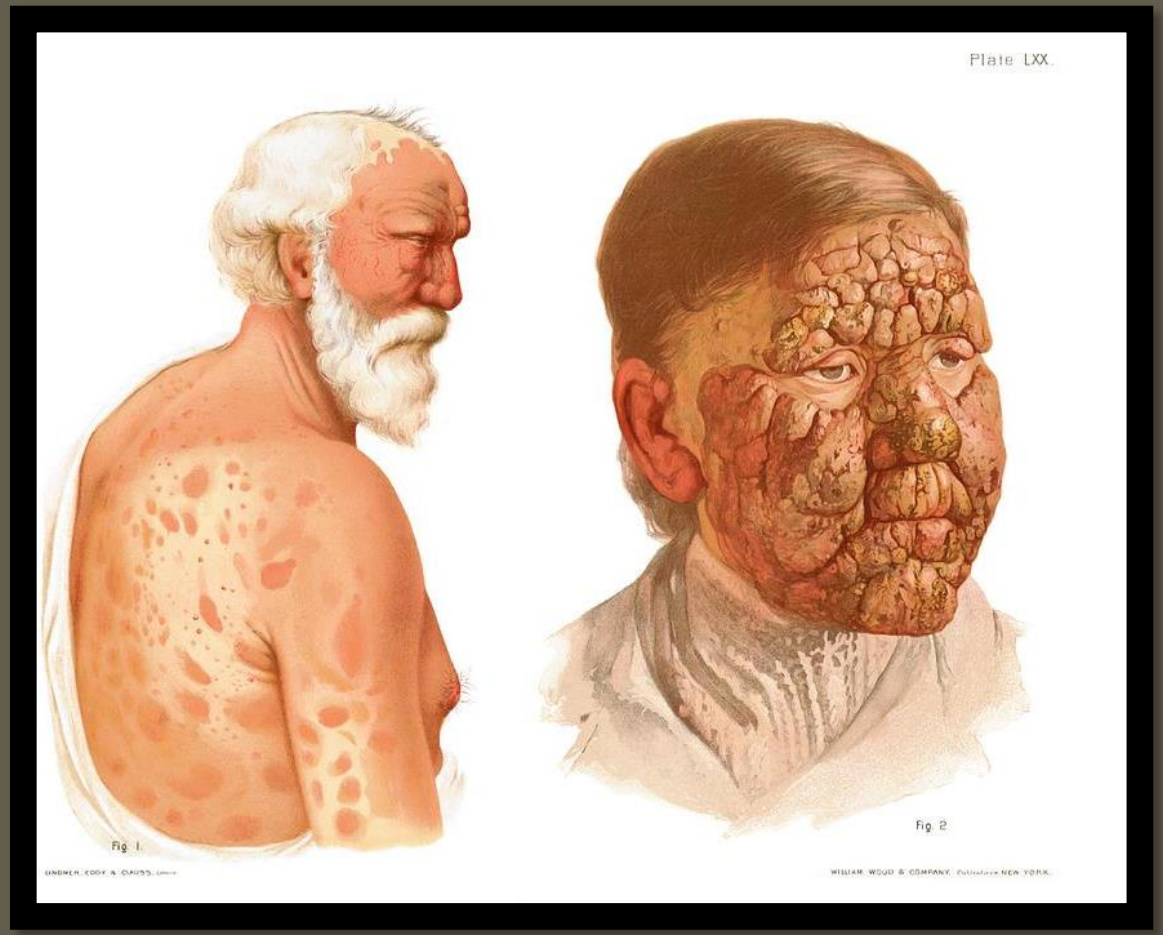
- Poverty
- Poor diet
- Poor access to health care
- Lack of education
- Living in close contact with someone suffering from leprosy

India. Robbins et al. 2009

Disease III Leprosy

Signs

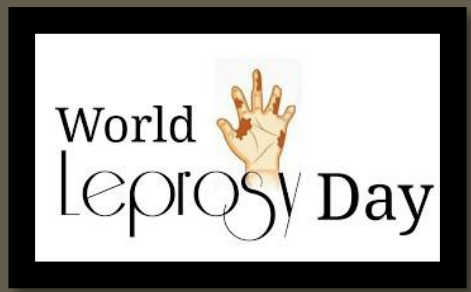
1. **Earliest signs** : skin lesions (bacteria), contracted fingers and toes (motor nerves)
2. Loss of eyebrows/ eyelashes
3. Nasal collapse
4. Ulcers, swelling of lower legs, hands & feet
5. Joint degeneration
6. Facial paralysis
7. Psychological problems (stigma)



Disease III Leprosy

Symptoms

1. Hoarse voice
2. Sight, smell, touch, hear, taste
3. Loss of appetite and weight
4. Respiratory system problems (including sinus and chest pain)
5. Nerve pain –leprosy reactions (acute inflammatory episode)
6. Eyes, kidneys and liver, adrenal glands, testes
7. Bones and teeth



Not all people who are infected with M. Leprae develop symptoms

Disease III Leprosy

Skeletal Manifestations

Skeletal changes: ca 5%:

- Facial bones
- Hands
- Feet
- Lower legs
- Distribution pattern

Direct effects

- Rhinomaxillary syndrome/facies leprosa
- Leprous osteomyelitis

Indirect effects

- Sensory neuropathy
- Motor neuropathy
- Autonomic neuropath

Loss of the anterior nasal spine, widening of the nasal aperture, and remodeling of the nasal aperture edges of a person who had experienced leprosy during life.

Disease III Leprosy

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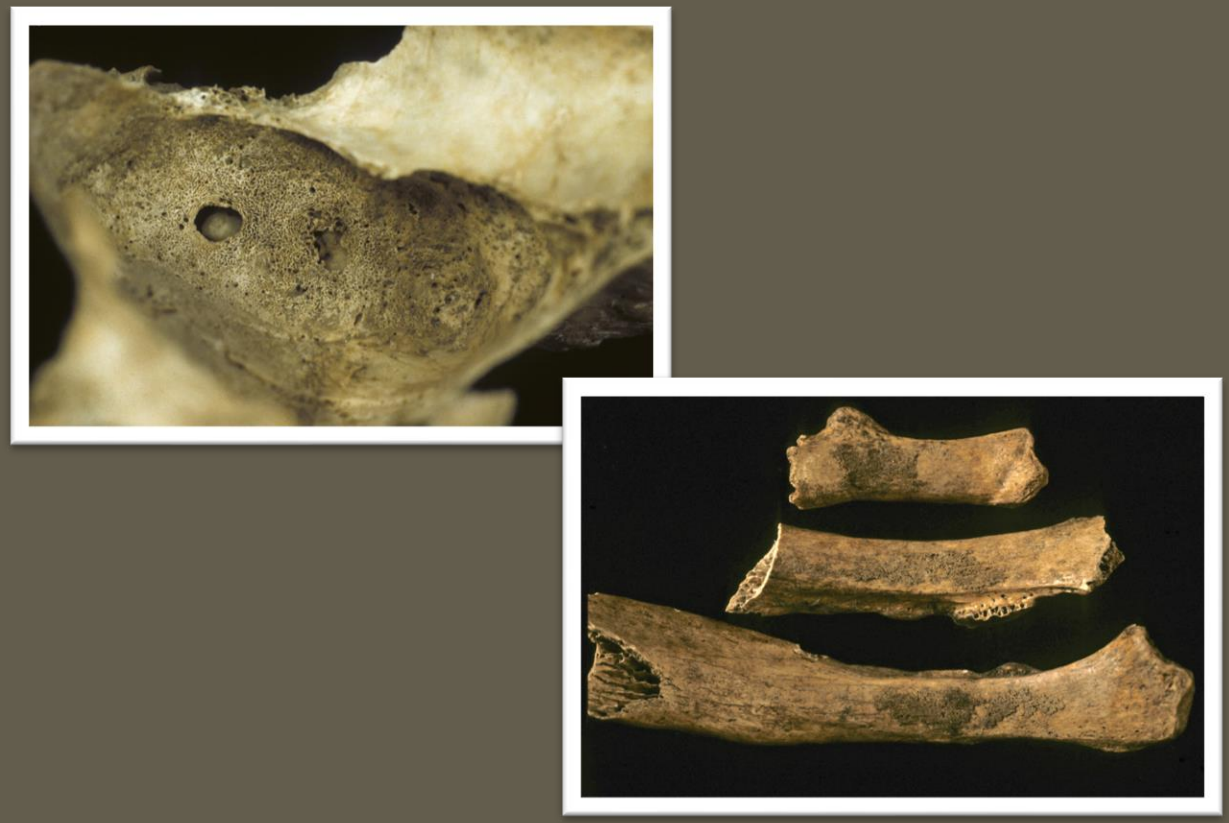

New bone formation on the floor of the sinus. New bone formation on the visceral surfaces of the ribs

Disease III Leprosy

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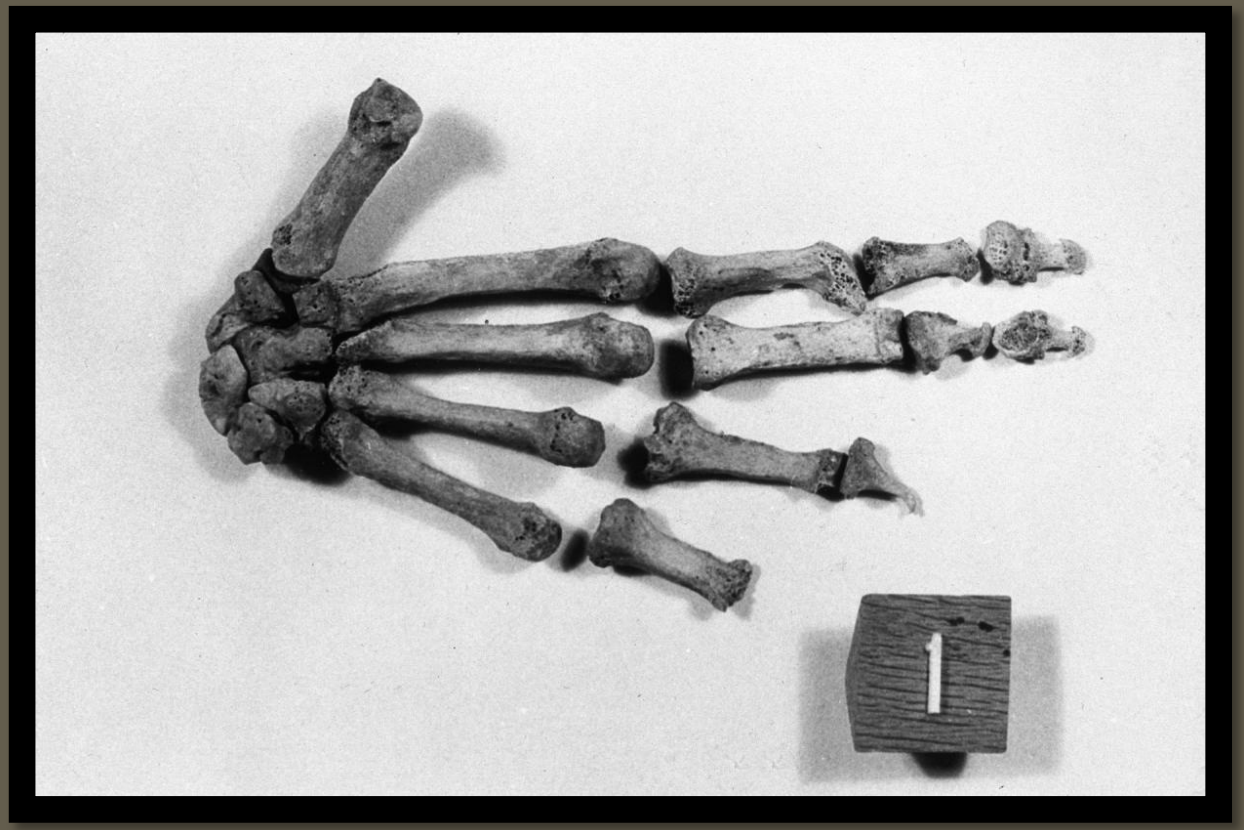


Absorption and remodeling of some of the left hand bones of a person who had experienced leprosy during life (Medieval Denmark)

Disease III Leprosy

Skeletal Manifestations

Skeletal changes: ca 5%:

- Facial bones
- Hands
- Feet
- Lower legs
- Distribution pattern

Direct effects

- Rhinomaxillary syndrome/facies leprosa
- Leprous osteomyelitis

Indirect effects

- Sensory neuropathy
- Motor neuropathy
- Autonomic neuropath

Absorption of the distal ends of the 2nd to 4th metatarsals and concentric remodeling of proximal phalanges of the left foot of a person who had experienced leprosy during life (Medieval France).

Disease III Leprosy

Skeletal Manifestations

Skeletal changes: ca 5%:

- Facial bones
- Hands
- Feet
- Lower legs
- Distribution pattern

Direct effects

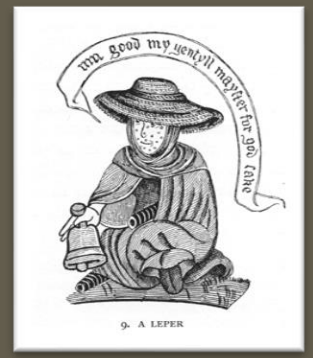
- Rhinomaxillary syndrome/facies leprosa
- Leprous osteomyelitis

Indirect effects

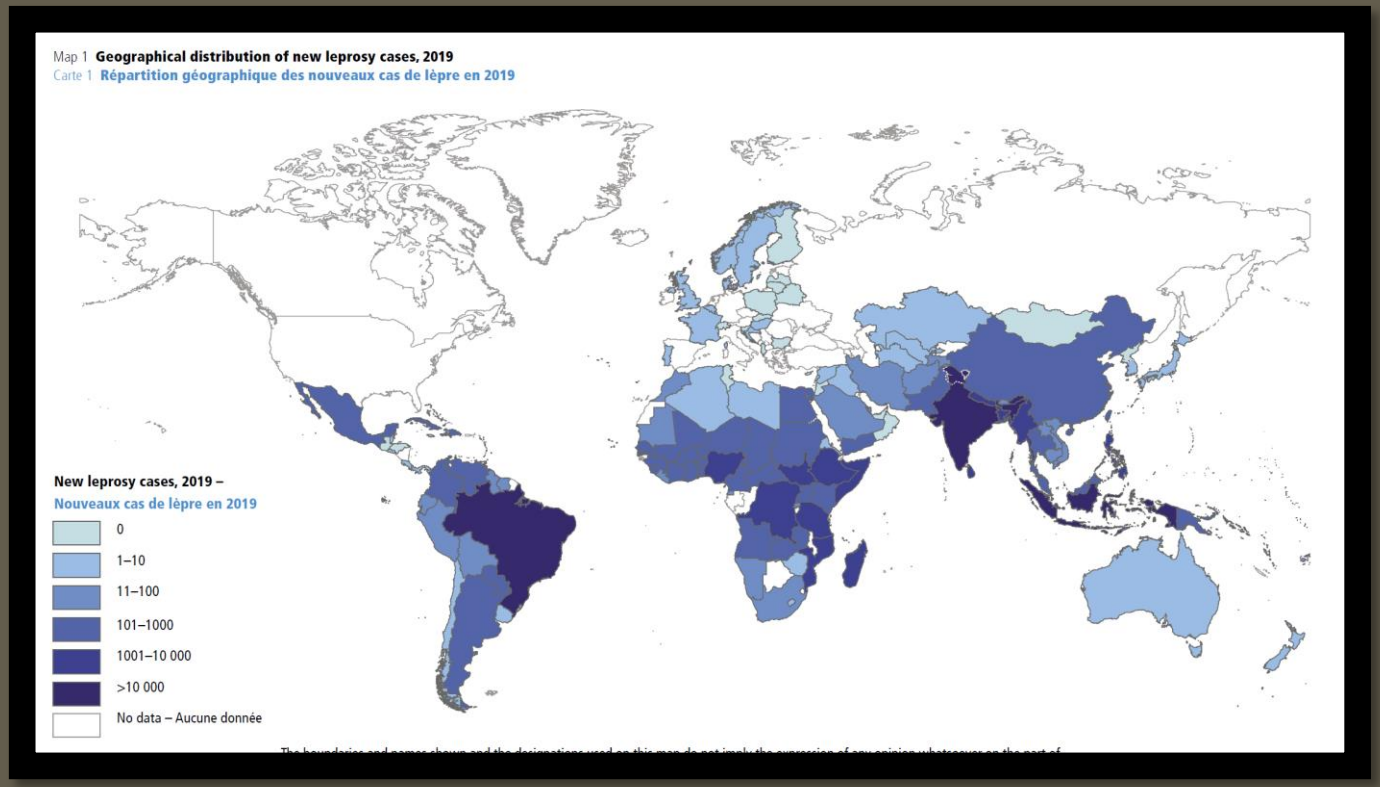
- Sensory neuropathy
- Motor neuropathy
- Autonomic neuropath

Extensive new bone formation on the tibiae and fibulae of the skeleton of a person who had experienced leprosy in life (Medieval England).

Disease III Leprosy
Today



- Recent decline
  - **1985**: 5.2 million "cases" globally
  - **1991**: world health assembly pledged to eliminate leprosy by AD 2000 (prevalence <1 per 10,000)
  - Average decline of 20% since **2001** due to multidrug therapy (MDT), education, living condition improvements
  - **2018**-209,000 cases globally

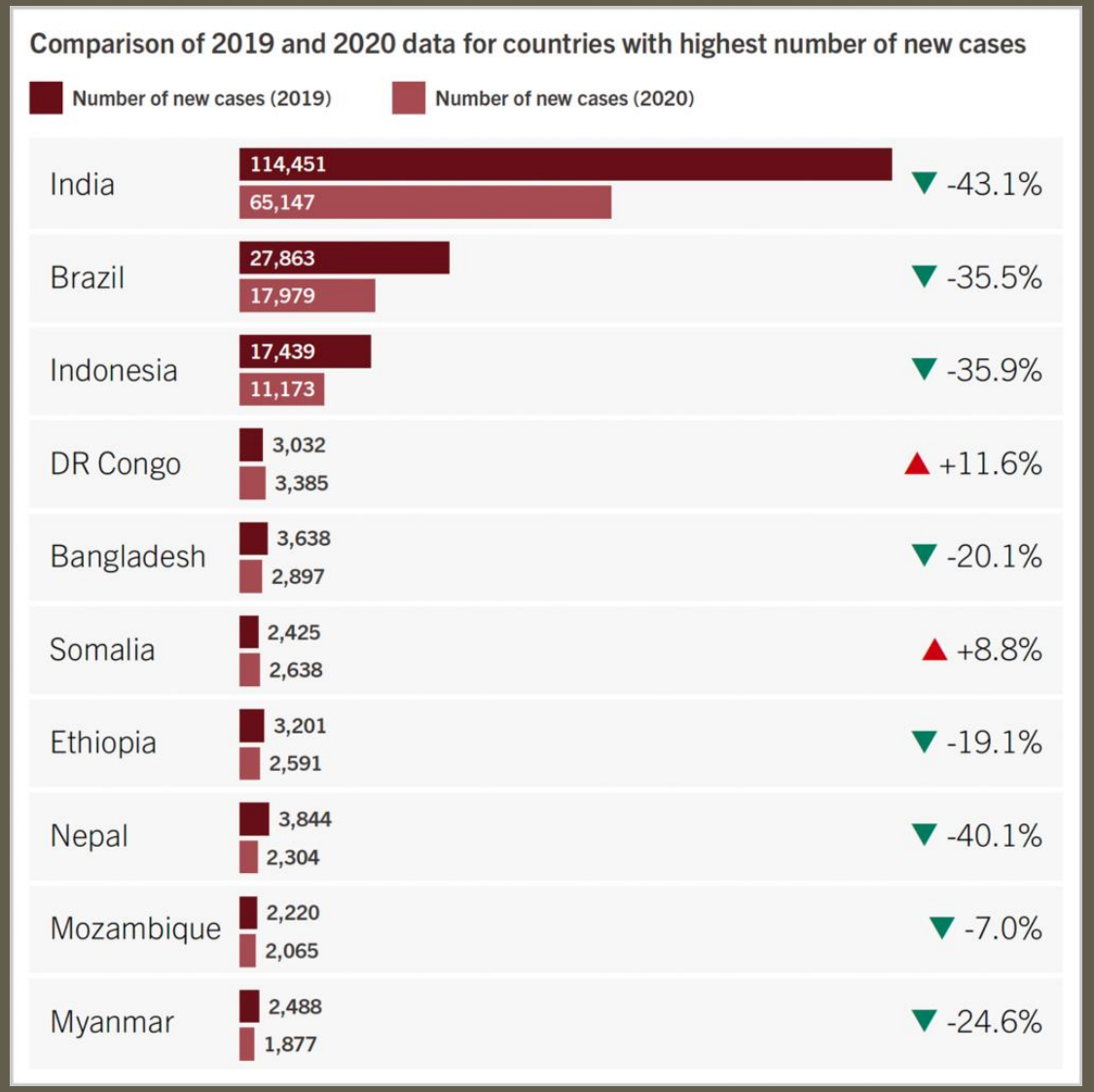


Still problems of control, despite 95% of the population having a natural resistance to the disease

Disease III Leprosy

Today

still occurs in more than 120 countries, with more than 200 000 new cases reported every year...



Palaeopathology is not a hobby, it is a scientific crossroad nurtured by history, archaeology, anthropology & medicine.