Durham University

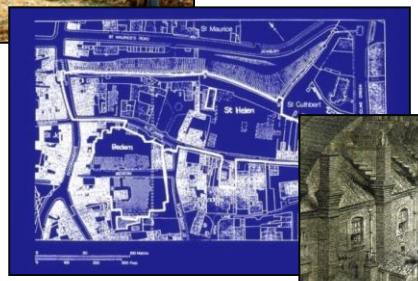
The Archaeology of Disease Documented in Skeletons

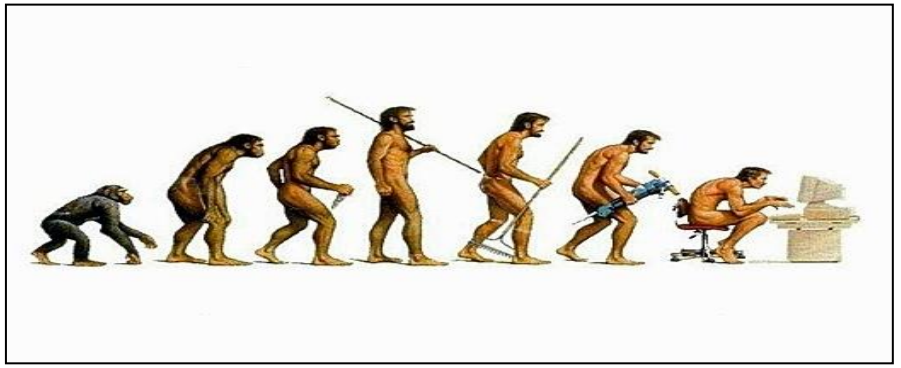
Charlotte Roberts,
Department of Archaeology, Durham University


Abdijmuseum Ten Duinen, Belgium

Gresham College Lecture, at the Museum of London, October 26th 2015

Bioarchaeology: Studying past people's human remains





People shaped the past and
Created the sites archaeologists excavate
Study of their remains enables us to understand how they interacted with their environments, and to
Help people today appreciate how we have evolved and adapted to change over the epidemiological transitions
The last 10,000 years of health changes has set the stage for what we are today

Grand challenges for archaeology

Keith W. Kintigh[a,1], Jeffrey H. Altschul[b], Mary C. Beaudry[c], Robert D. Drennan[d], Ann P. Kinzig[e], Timothy A. Kohler[f,g], W. Fredrick Limp[h], Herbert D. G. Maschner[i], William K. Michener[j], Timothy R. Pauketat[k], Peter Peregrine[a,l], Jeremy A. Sabloff[g], Tony J. Wilkinson[m], Henry T. Wright[a,n], and Melinda A. Zeder[o]

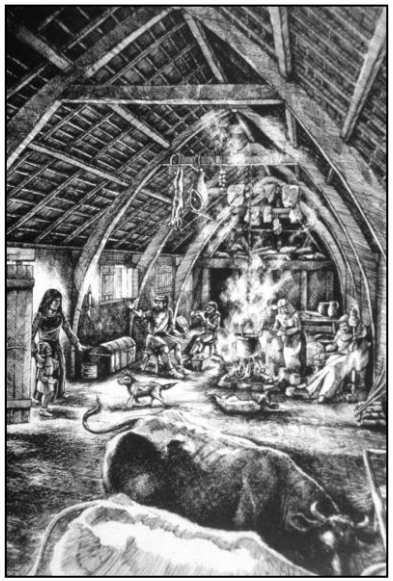
by culture- their natur addressed ity, demogr

2014 *Proceedings National Academy Science* 111:879-890

1. Emergence, communities, and complexity
2. Resilience, persistence, transformation, and collapse
3. Movement, mobility, and migration
4. Cognition, behavior, and identity
5. Human-environment interactions

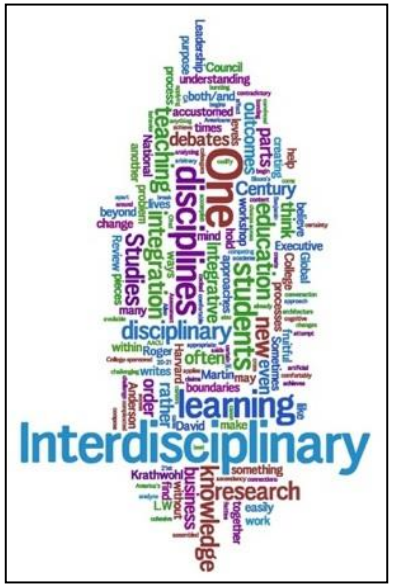
'They show an increasing concern with relevance to the modern world' (p. 879)

Bioarchaeology in particular can contribute to all these themes



Bioarchaeology is about contextualising data……

…and is question driven



A bit of history of UK bioarchaeology

In the 1980s

Fewer people

Male dominated!

Not generally contextualised

British Association for Biological Anthropology and Osteoarchaeology

From the 1990s

Many MSc courses(currently 12)

More PhDs & academic posts

1990: changes in commercial archaeology

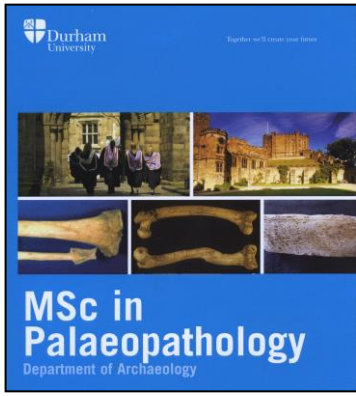
Recognition of bioarchaeology's value

1998: BABAO founded

Guidance documents

Standards for recording

Better infrastructure and funding



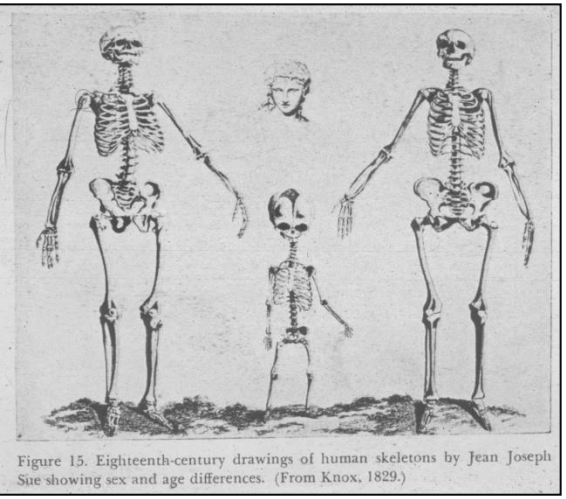
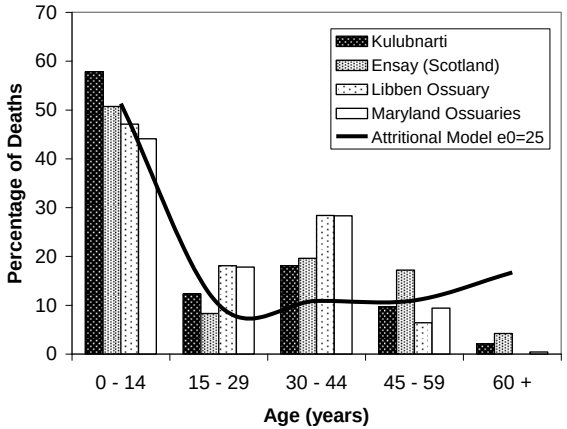
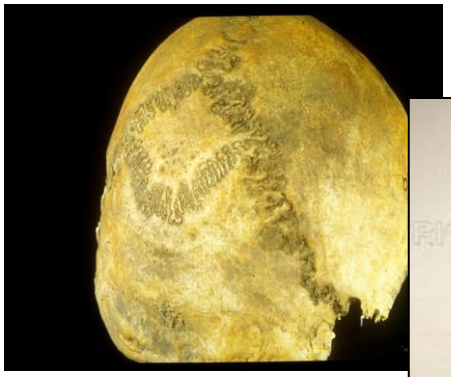
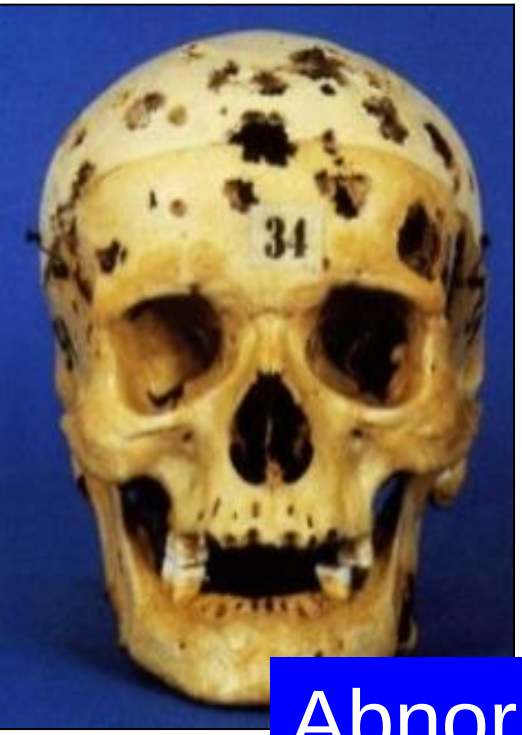


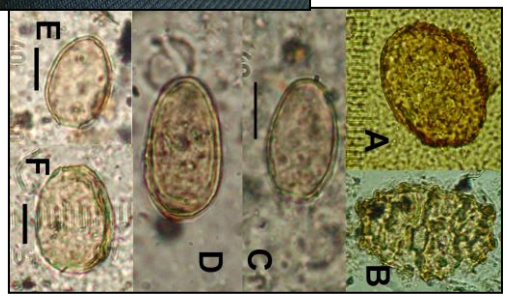
Figure 15. Eighteenth-century drawings of human skeletons by Jean Joseph Sue showing sex and age differences. (From Knox, 1829.)

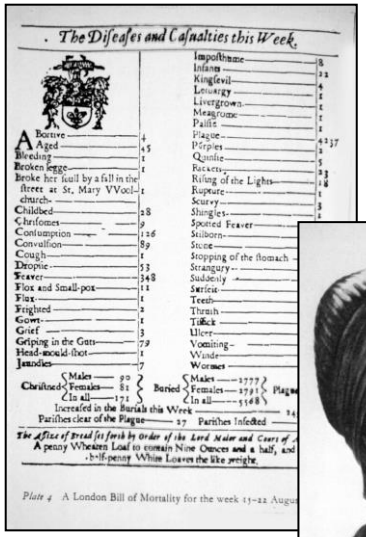




It documents normal and abnormal variation in human skeletons



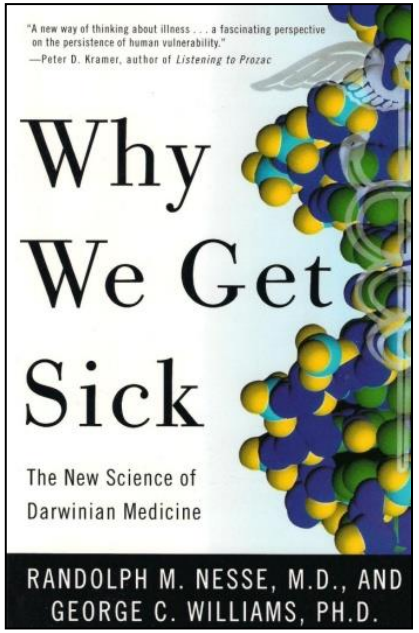




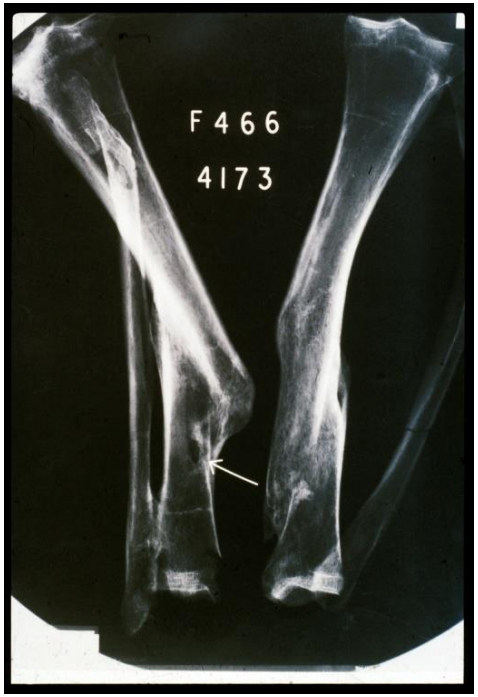
Abnormal variation = palaeopathology

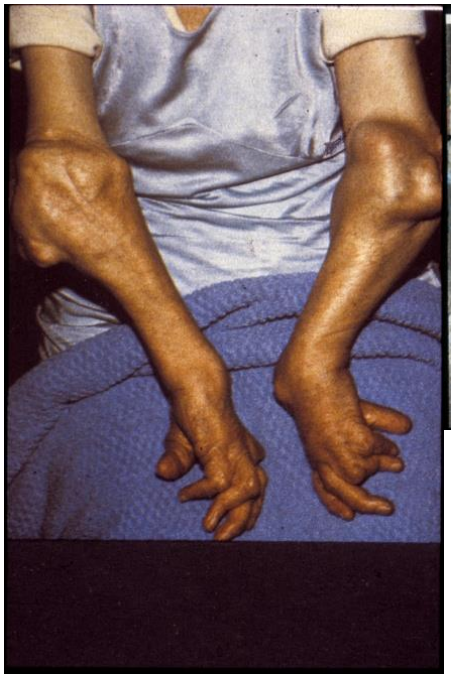
Why study palaeopathology?

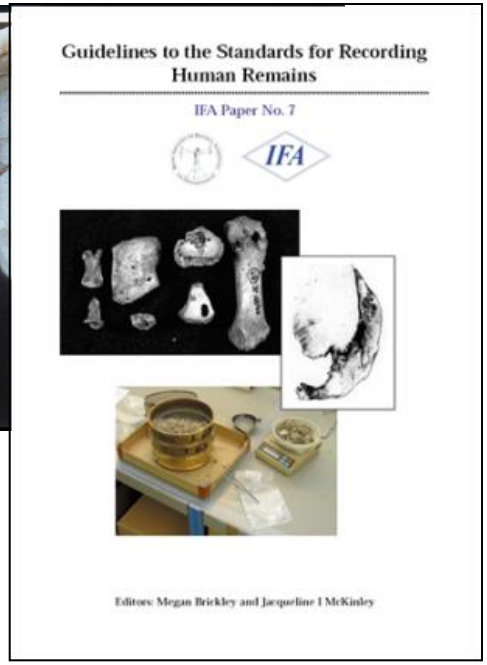
- Direct evidence for disease
- Shows the history of disease without impact of modern therapy
- Provides a ‘long view’ of disease origin, evolution and history
- Explores the impact of the interaction of people with their environments



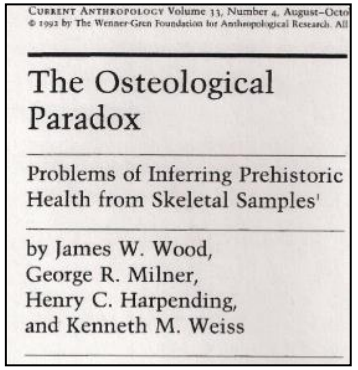
Methods of analysis







BUT ONLY A SMALL NUMBER OF DISEASES AFFECT THE SKELETON



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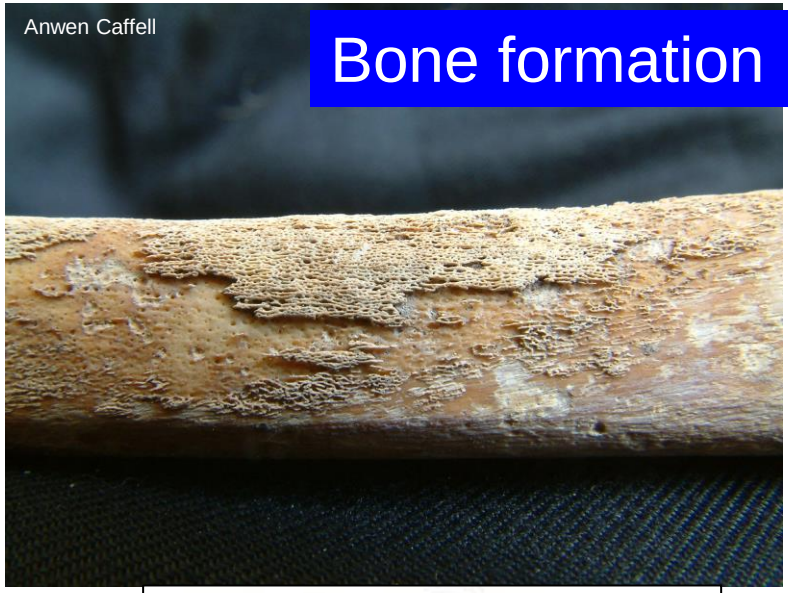
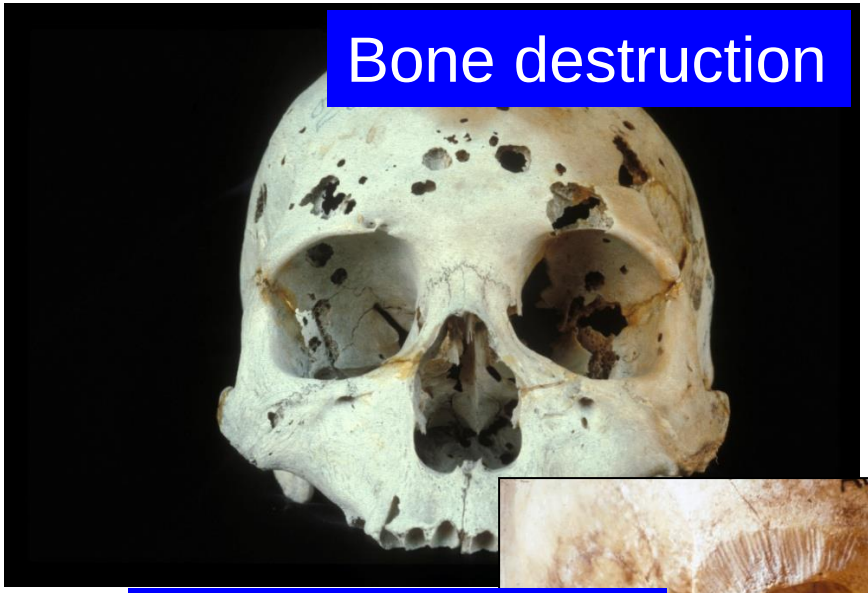


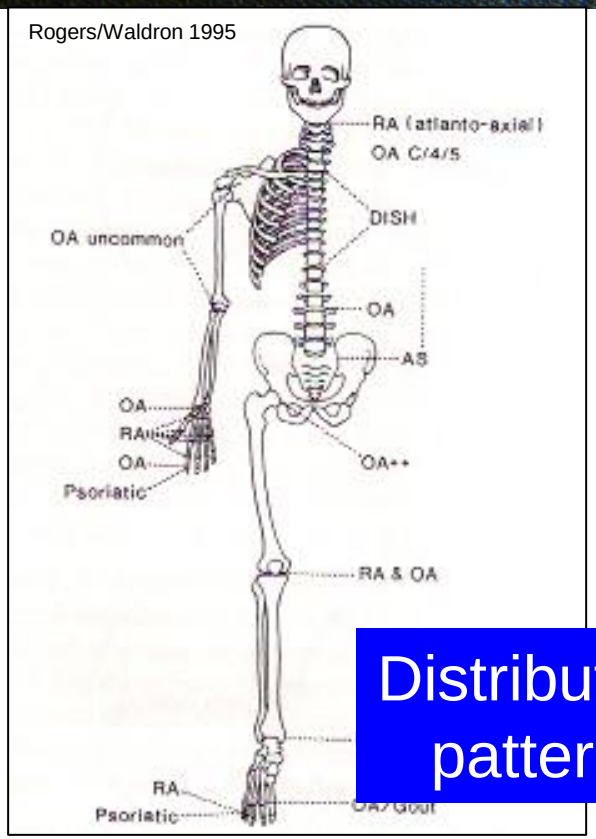
Bone formation



Bone destruction

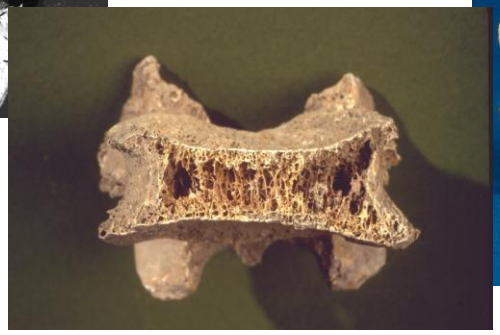
Pseudopathology

Rogers/Waldron 1995



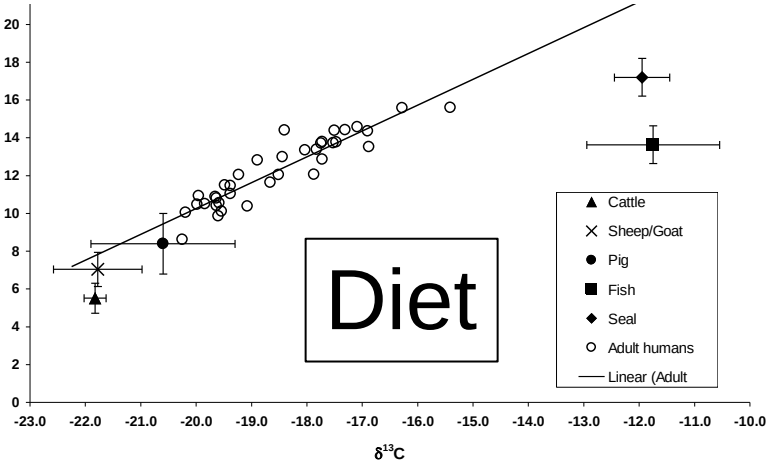
Distribution pattern

Differential diagnosis

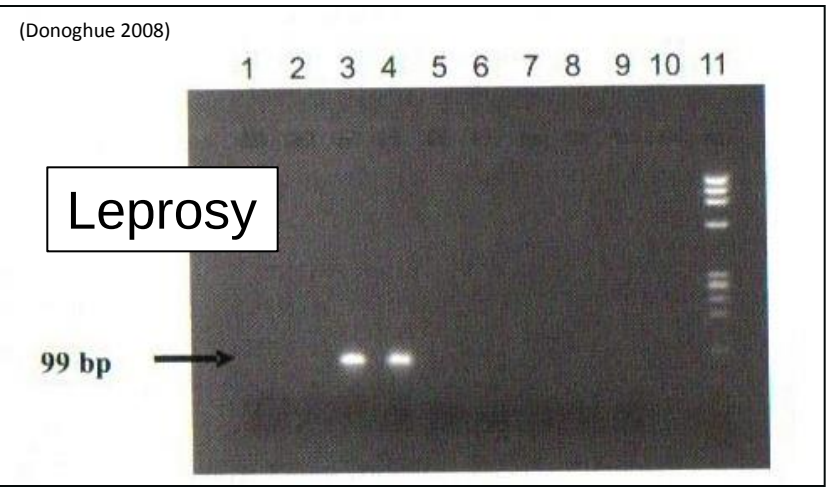


Isotope (chemical) analysis of teeth and bones

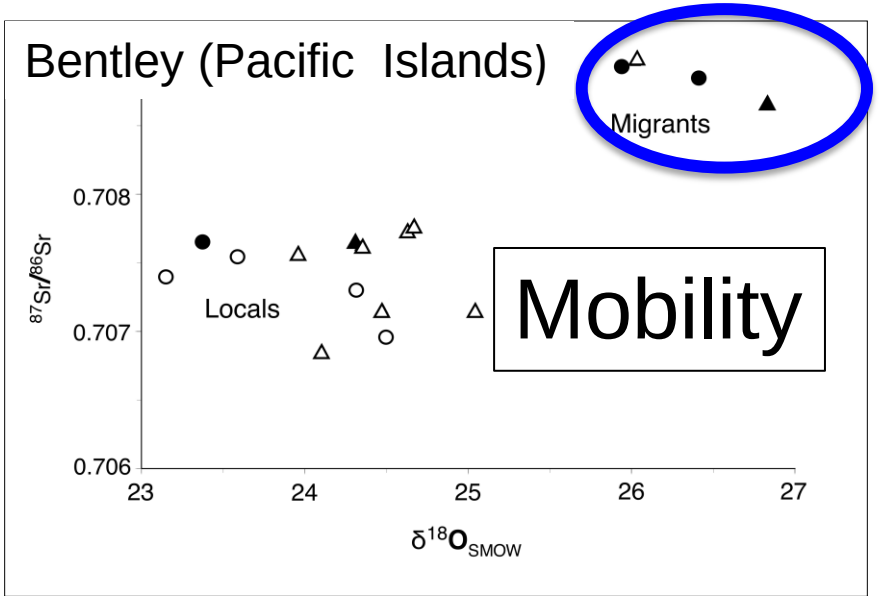
Richards (Orkney Islands 14th C AD)



(Donoghue 2008)



Bentley (Pacific Islands)



Ancient DNA analysis

1953: structure of DNA

1993 UK's Ancient Biomolecules Initiative

1985: 1st report: Egyptian mummy
1989: 1st bones (forensic)
1993: 1st pathogen aDNA (archaeological)

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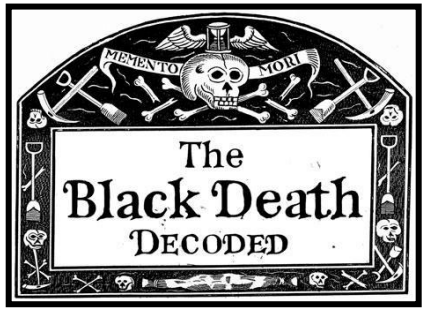
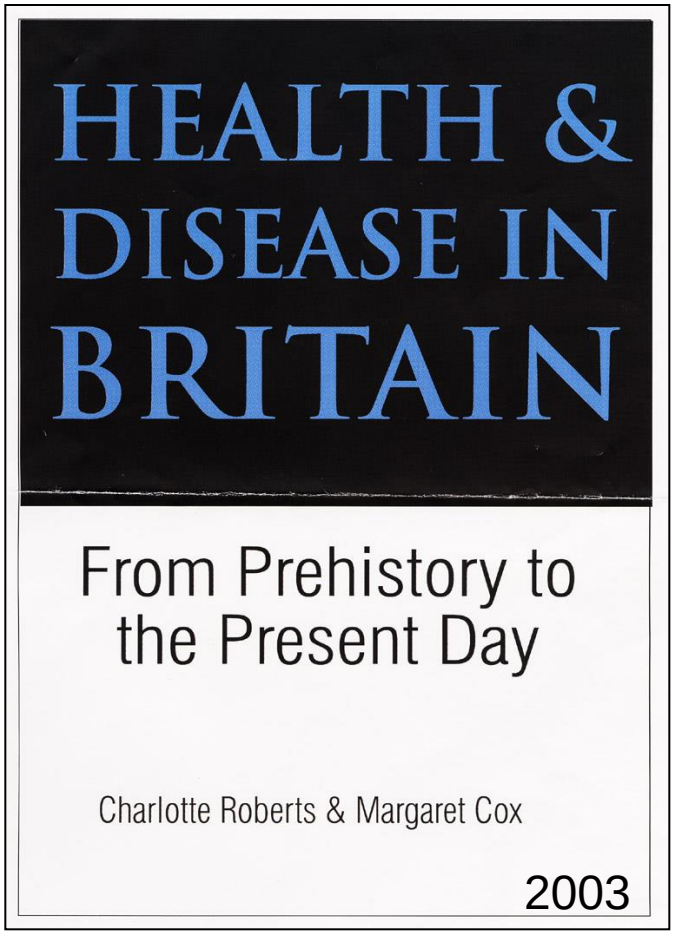


Bos et al 2011
Nature

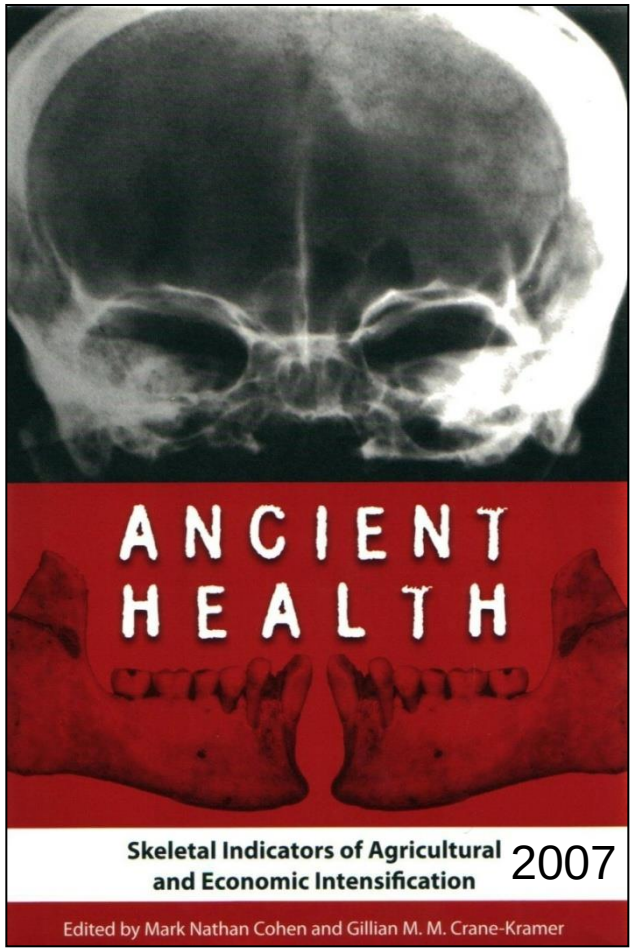
Warinner et al 2014
Nature Genetics

Modern and ancient genomes now being sequenced



34,778 skeletons from
211 archaeological sites

Health declines through time

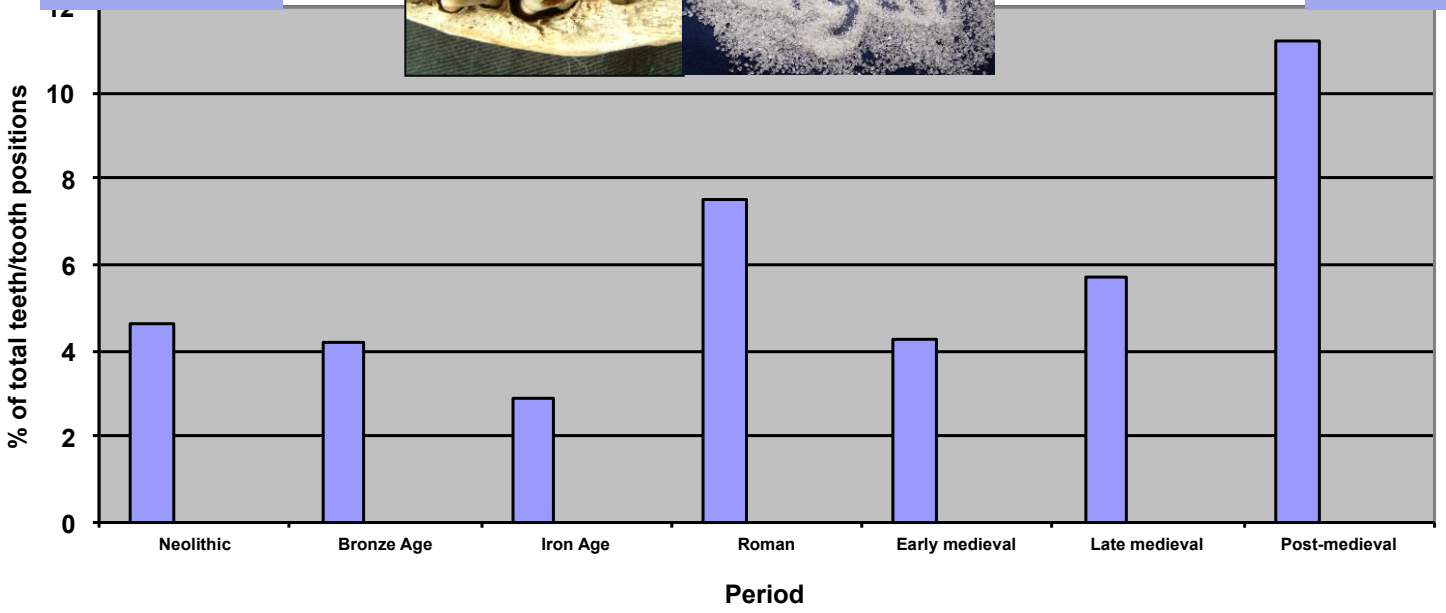


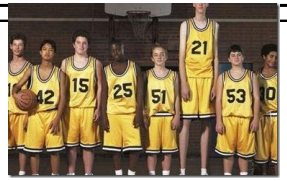
21 studies of health from the
Old and New Worlds

Health declines through time

4,000 BC

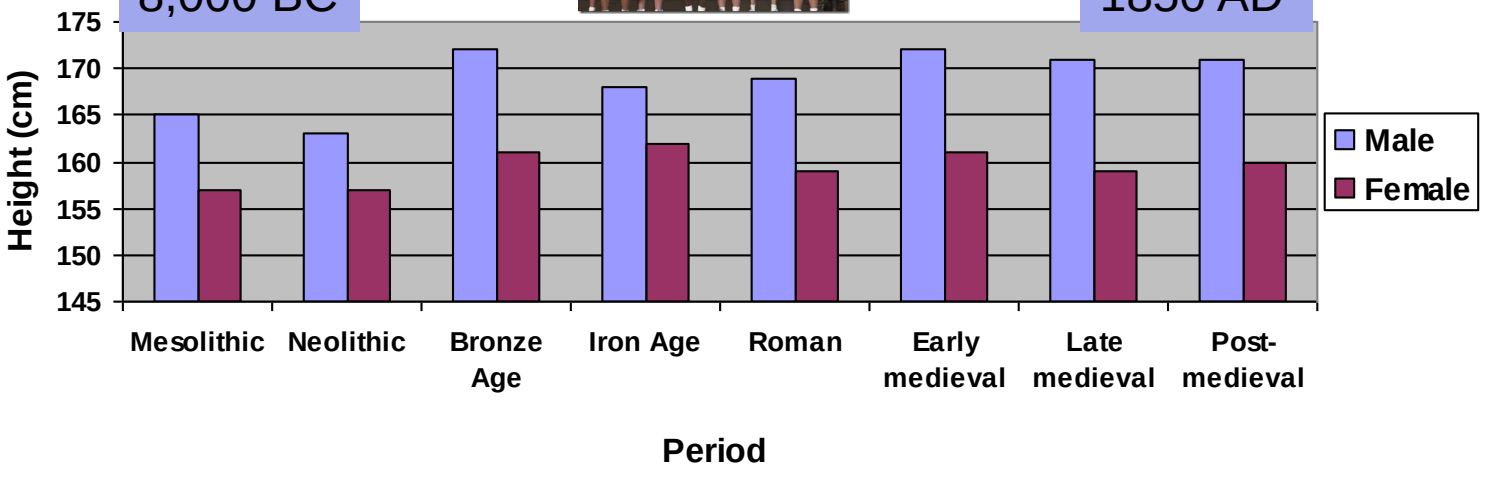
1850 AD





8,000 BC

1850 AD



TODAY

Males 1.76m

Females 1.62m

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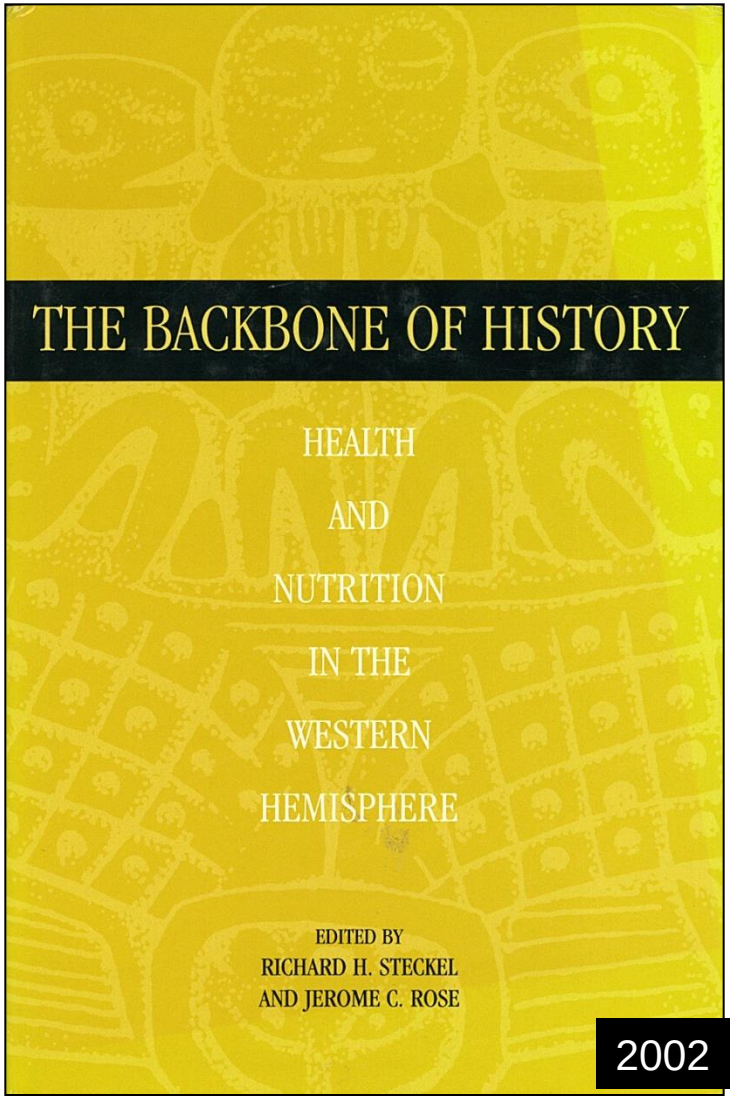
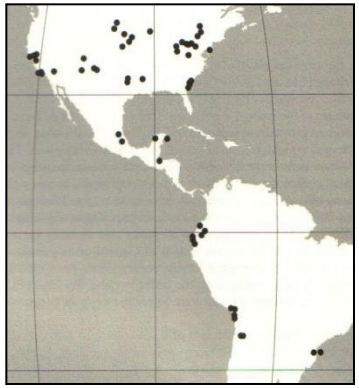
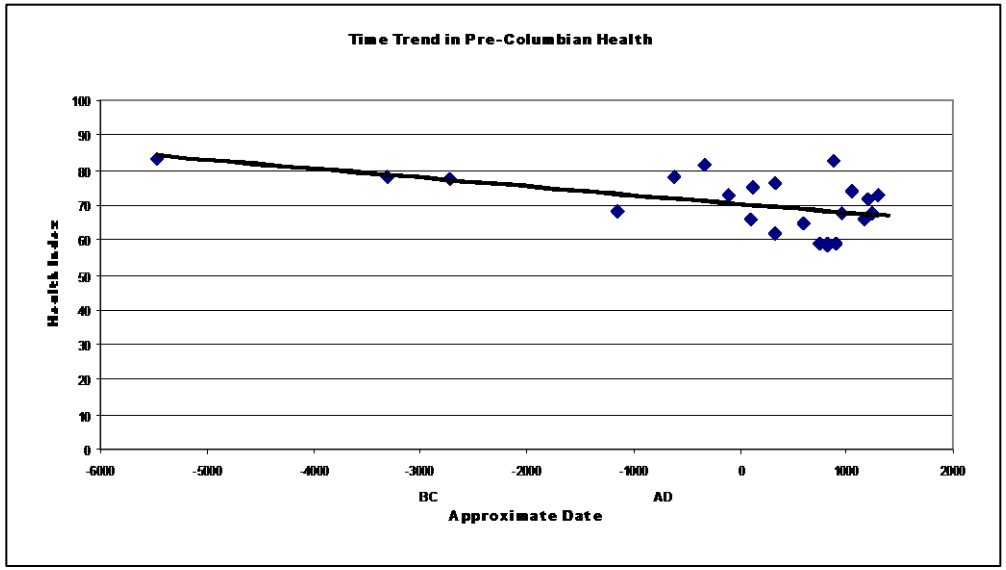
GLOBAL HISTORY OF HEALTH PROJECT





History of health in the Americas (12,000 skeletons)



Health declines through time

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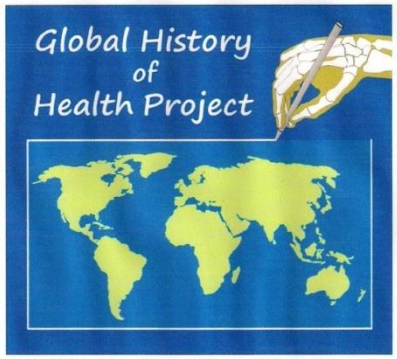
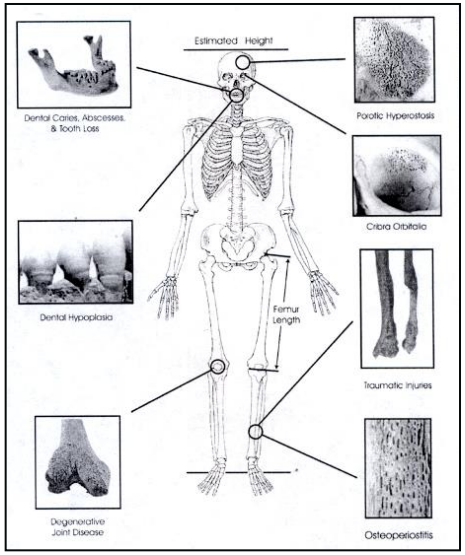
Reconstructing Health and Disease in Europe:
The Early Middle Ages through the Industrial Period.





Standard data
recording
online database

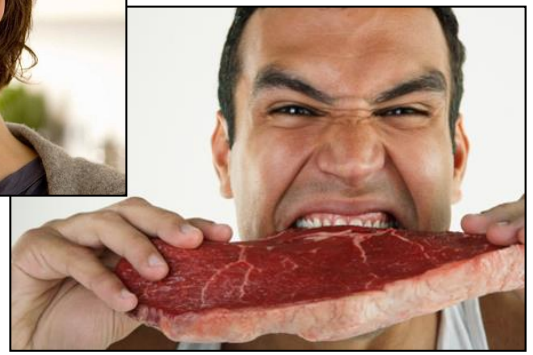
17,250 skeletons
Measures of ‘health’
Over time
Context and climate
Latitude/ longitude/ elevation

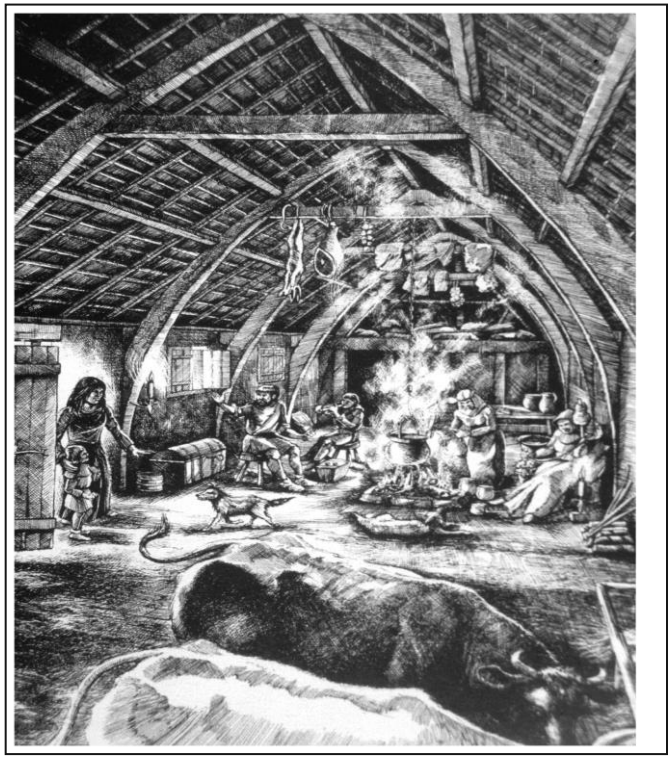
(http://global.sbs.ohio-state.ed

Tuberculosis

A bacterial infection

Mycobacterium tuberculosis - human
Mycobacterium bovis – animal





Steinbock 1976

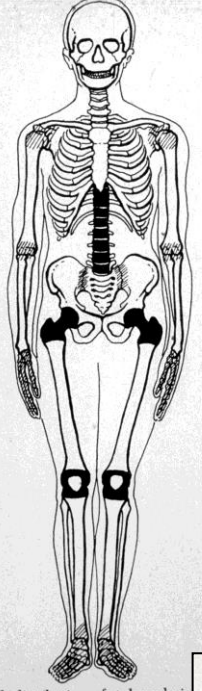
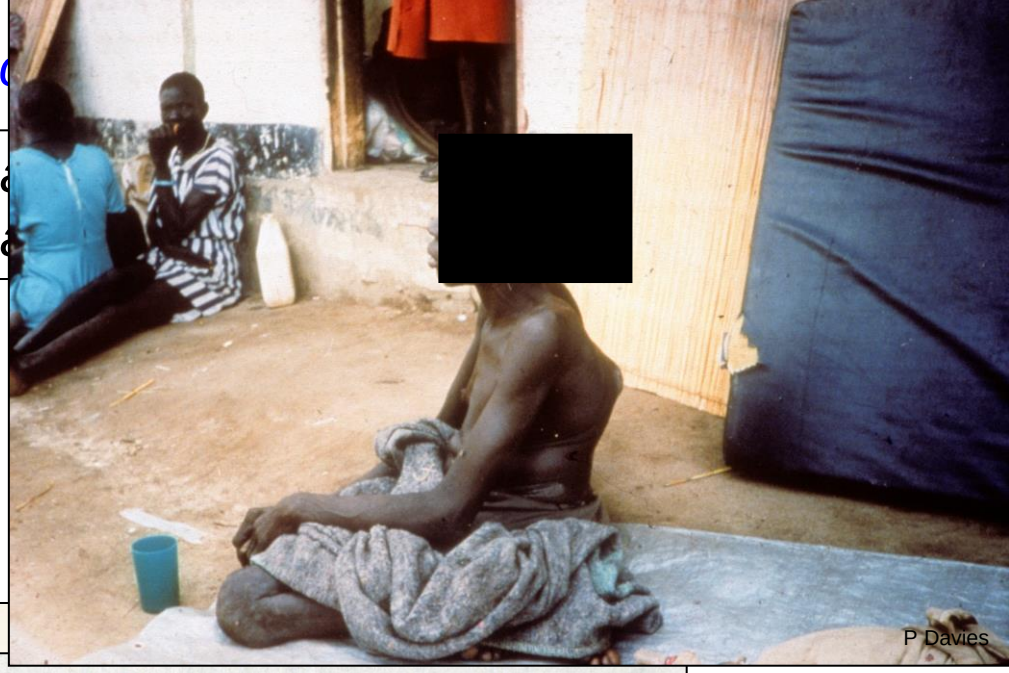


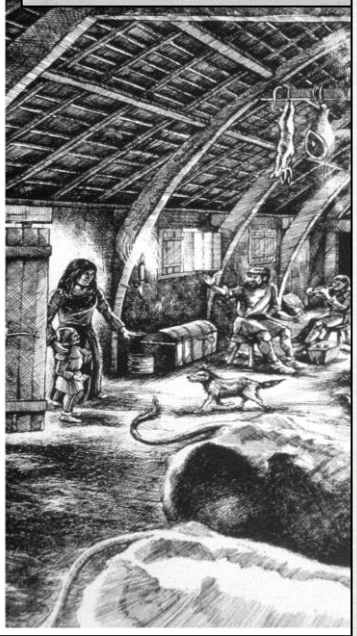
Figure 69. Skeletal distribution of tuberculosis. indicate the most frequent sites and diagonal lit

Mycobac

Mycoba
Mycoba



P Davies



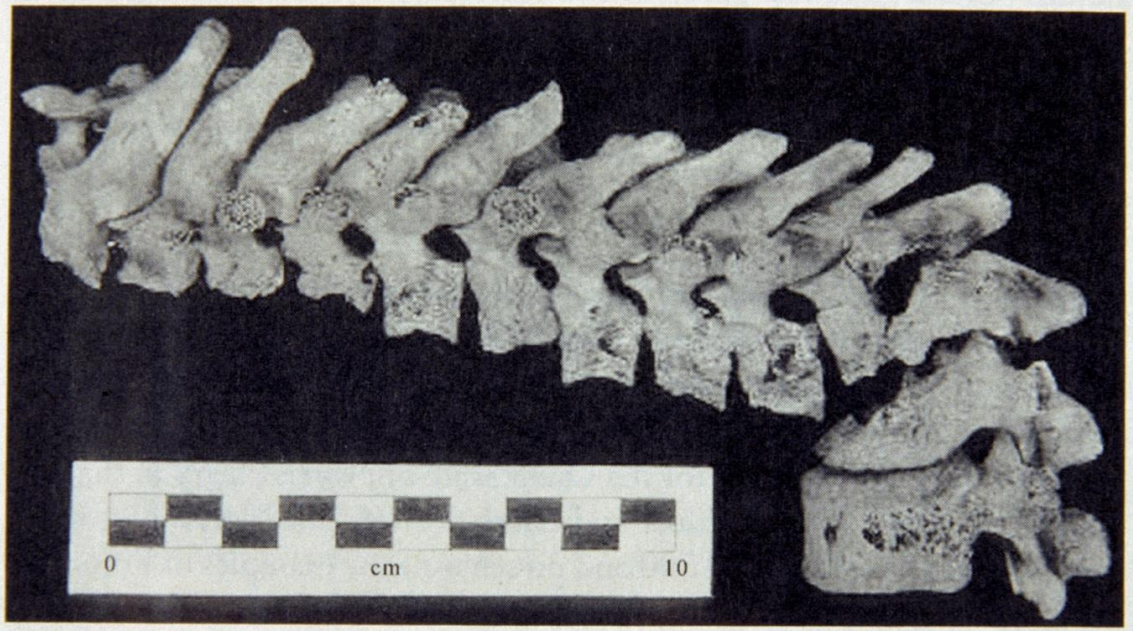
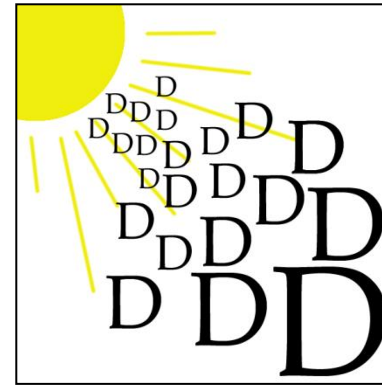
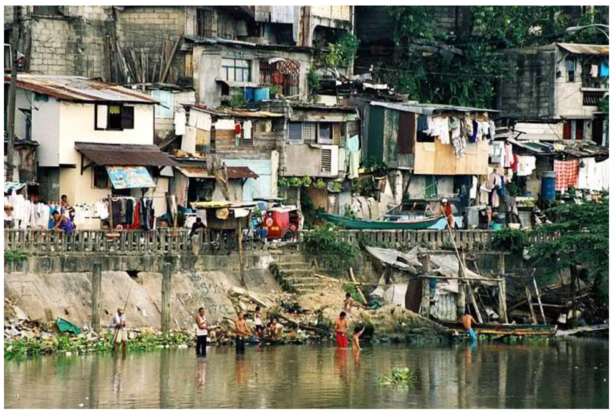
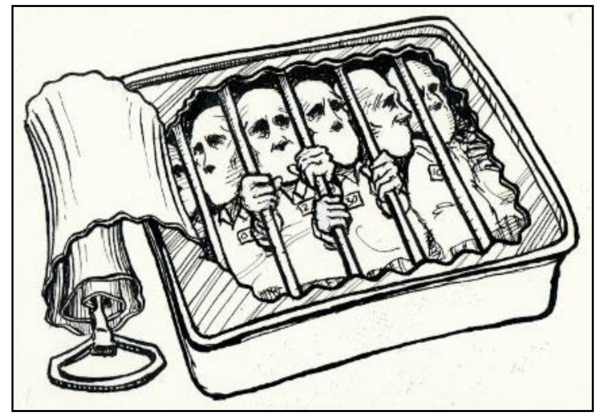


FIGURE 4.3 Pott's disease of the spine, Norris Farms site. Photo by George Milner; skeletal remains curated at the Illinois State Museum, Springfield.

Roberts & Buikstra 2003

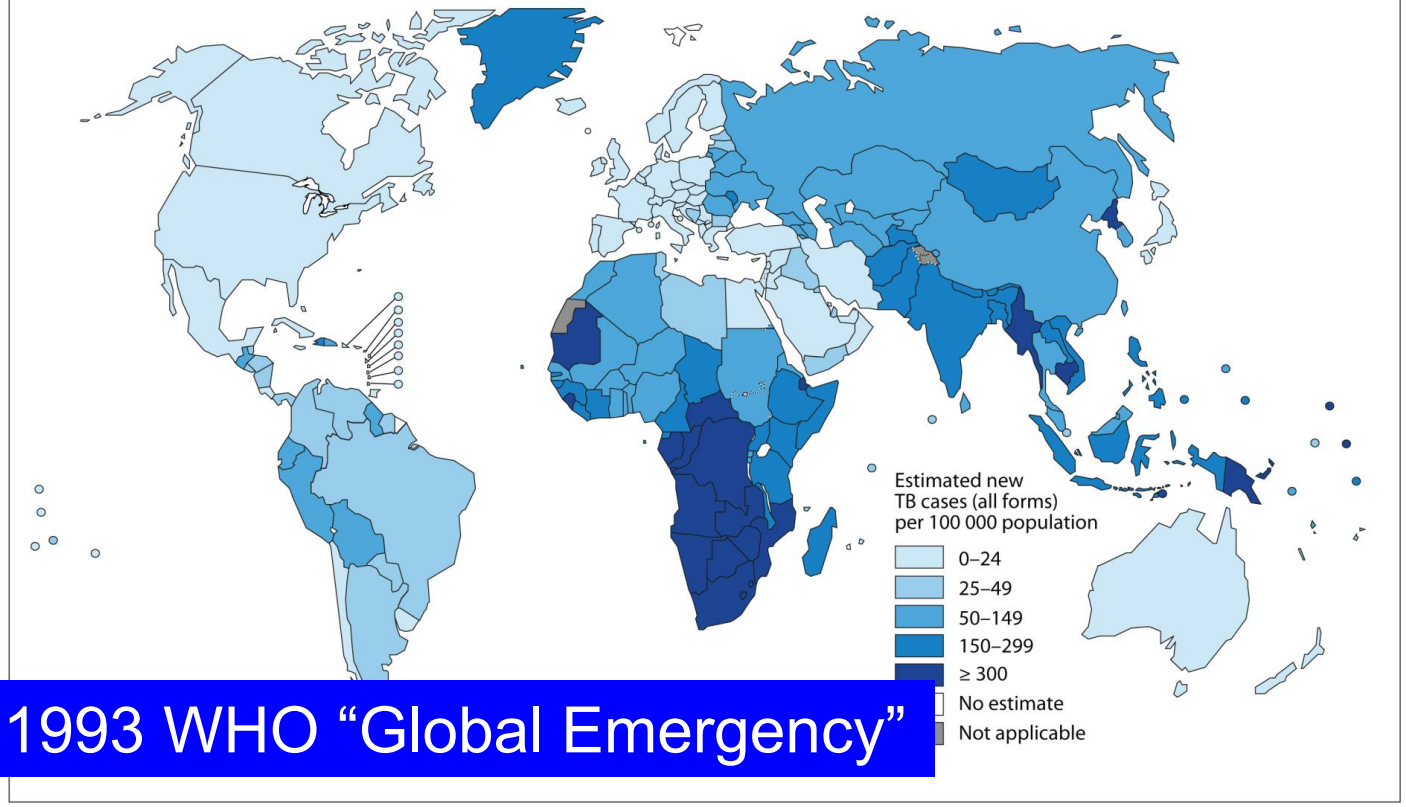


STRESS

© Burrard-Lucas.com

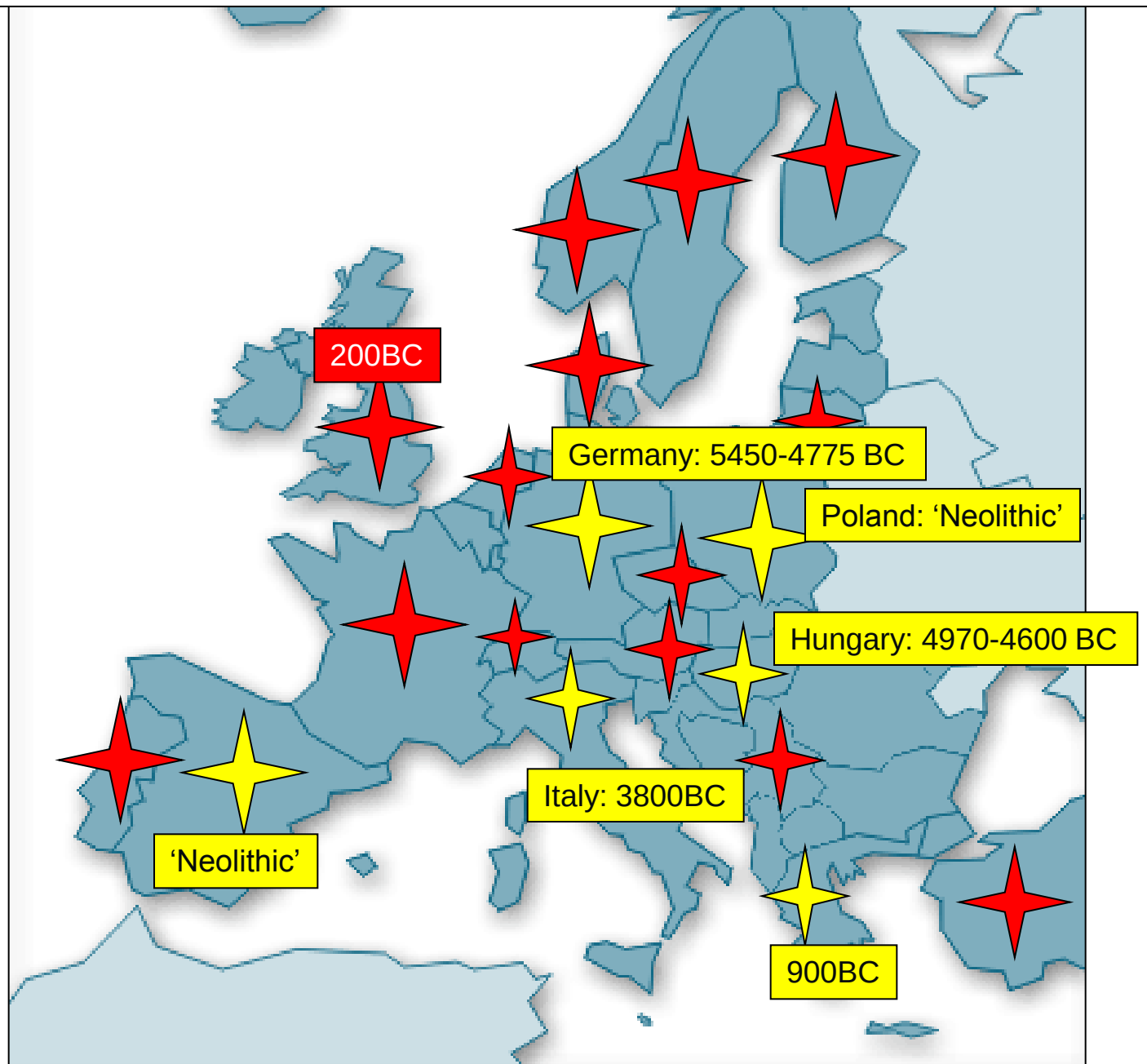

One third of the world's population affected



1993 WHO "Global Emergency"

Treated with multiple antibiotics; resistance common

Roberts & Buikstra 2003 *The bioarchaeology of tuberculosis. A global perspective on a re-emerging disease*. University Press of Florida



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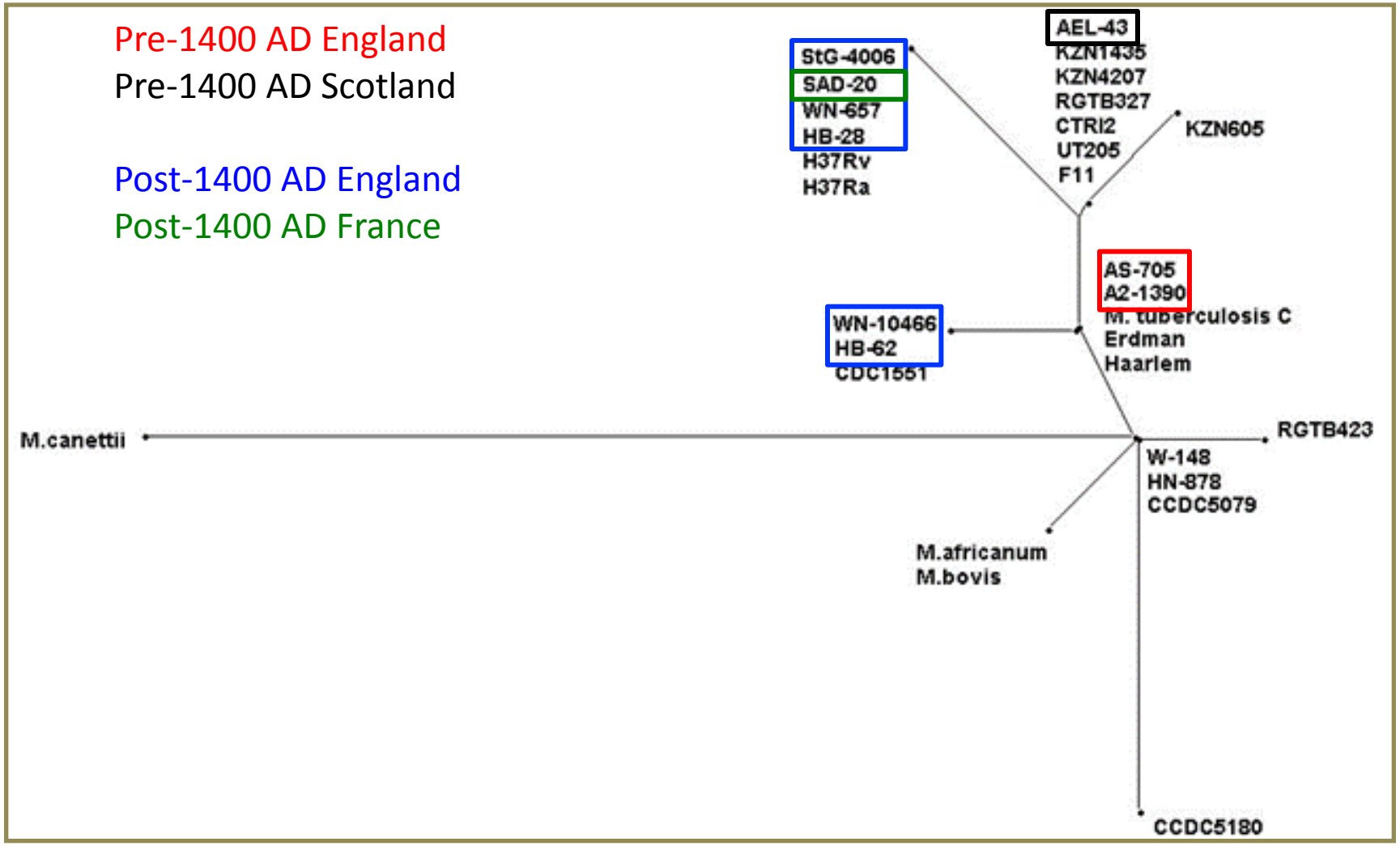
Müller *et al* 2014 *Proceedings Royal Society B* 281:20133236



People were probably moving around a lot!

Late Medieval TB bacterial strains

SCG 5 strain at Auldhame

SCG 3 strain at Leicester (100–200 years earlier)

Auldhame strain may have been introduced into Scotland from Scandinavia

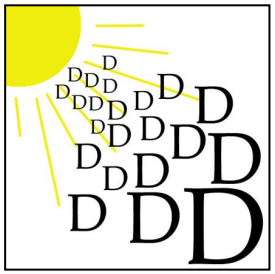
AND there is

Skeletal evidence of TB in Scandinavia prior to date of Auldhame

This actually tells us something about the evolution of TB

Leprosy

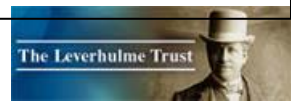
A bacterial infection



- Evidence in skeletons from 3 continents (Africa, Asia, Europe)
- Particularly common in Europe
- Especially Denmark, Hungary, Sweden, and the UK
- Most date to the late medieval period

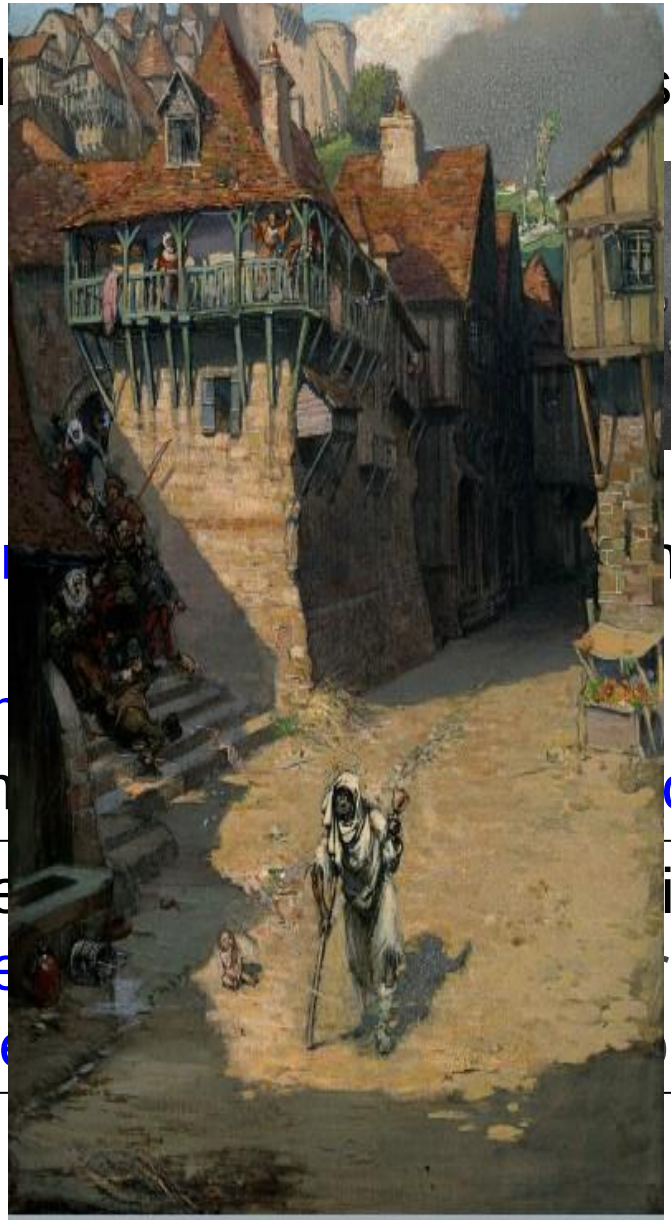
- Majority buried in non-leprosy hospital cemeteries; often in "normal" parish cemeteries

Roberts forthcoming *The past and present of leprosy*. University Press of Florida



Leprosy

- Evidence in skel s (Africa, Asia, Europe)



- Particularly comm nost countries had evidence
- Especially Denm and the UK
- Most burials from od of Europe

- Majority of the ske ied in non-leprosy hospital cemeterie rish cemeteries.
- Some burials were the rest

Questionnaire:

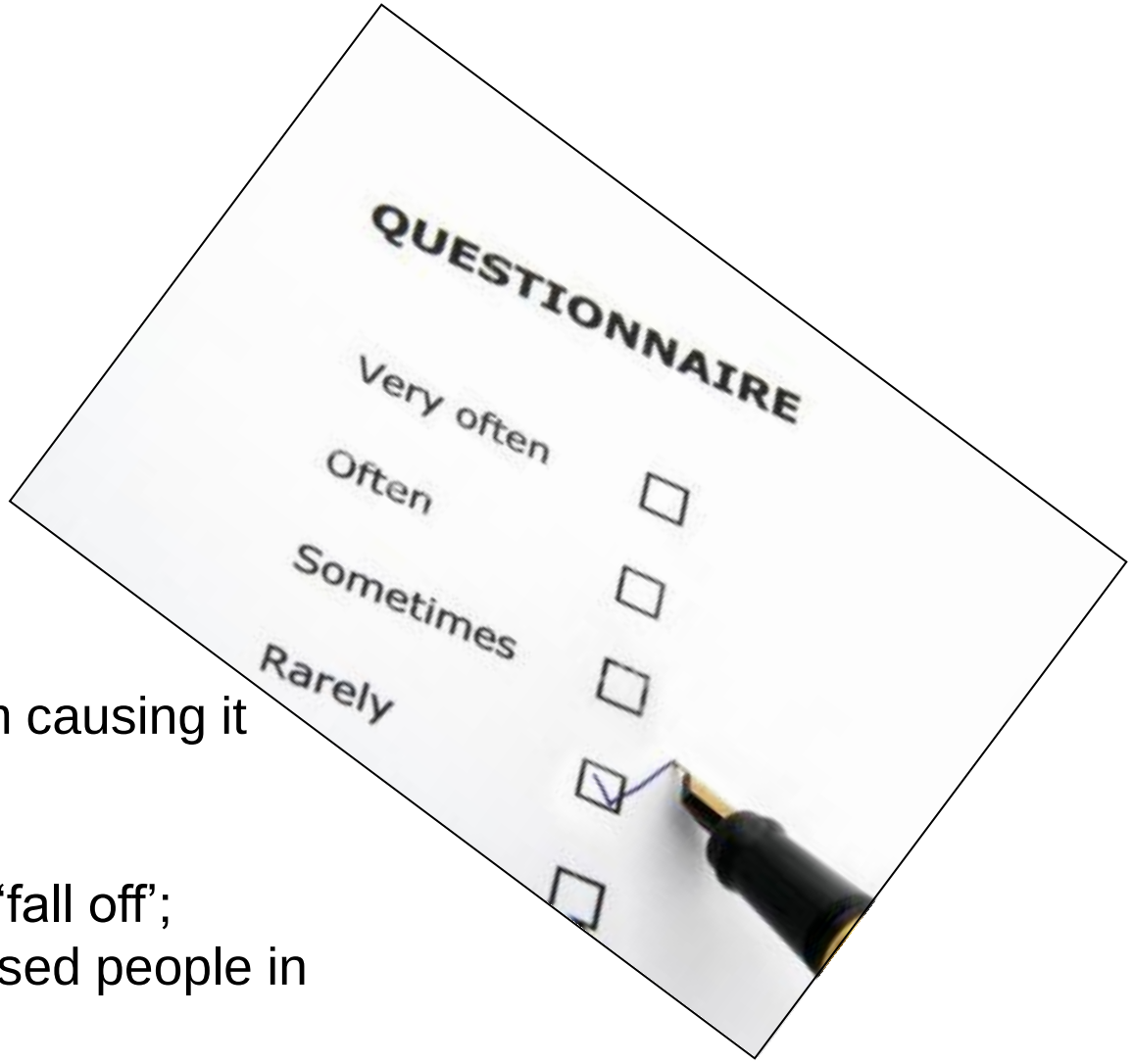
270 respondents

<u>Majority knew</u>:

- It's an infection
- Is most frequent in Asia
- Nerves most affected
- Is curable

<u>Mixed responses about</u>:

- The pathological organism causing it
- How it is contracted
- Predisposing factors
- Whether fingers and toes 'fall off';
- What happened to diagnosed people in the past

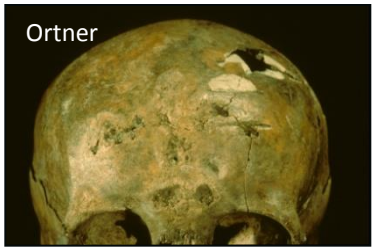


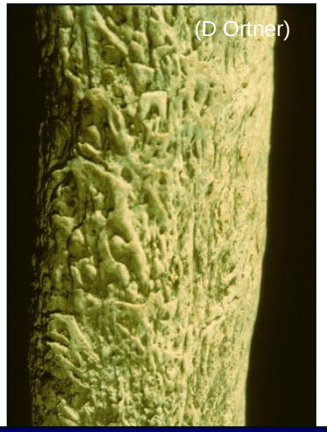
Comparison of knowledge between developed and developing countries: similar

Bacterial infection

Syphilis

245 burials
Monks
Lay people

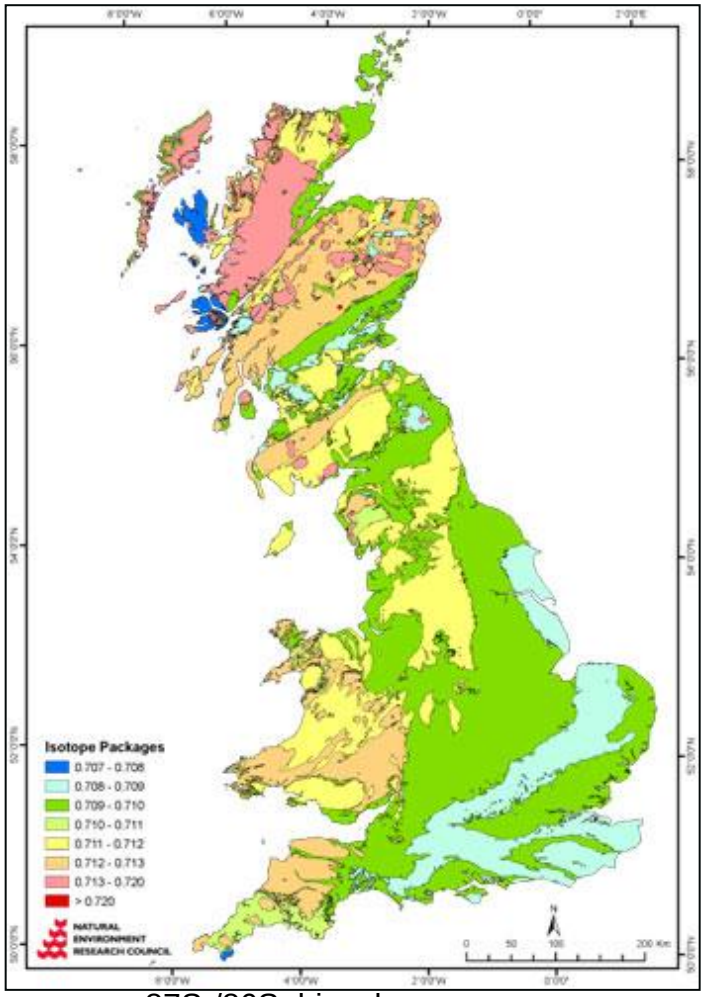




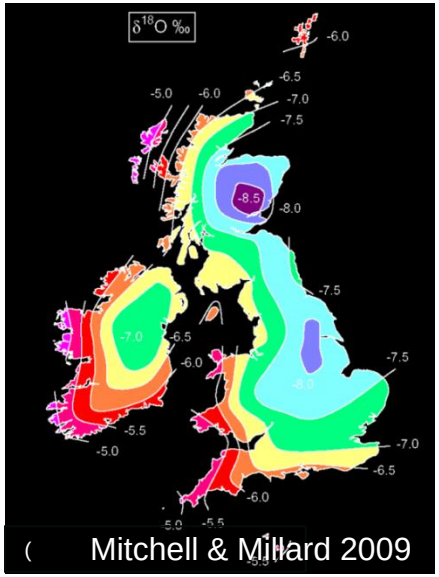
‘Hull Magistrates Court’
Augustinian Friary Church
(1316-1539)

Strontium

Geology, soils, food



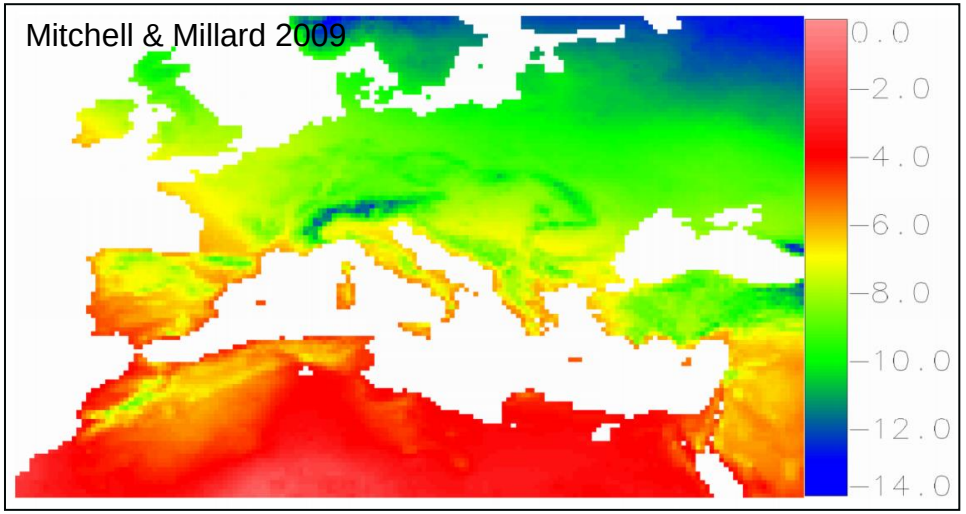
87Sr/86Sr biosphere map
(http://www.bgs.ac.uk/nigl/SBA_Methodology.htm

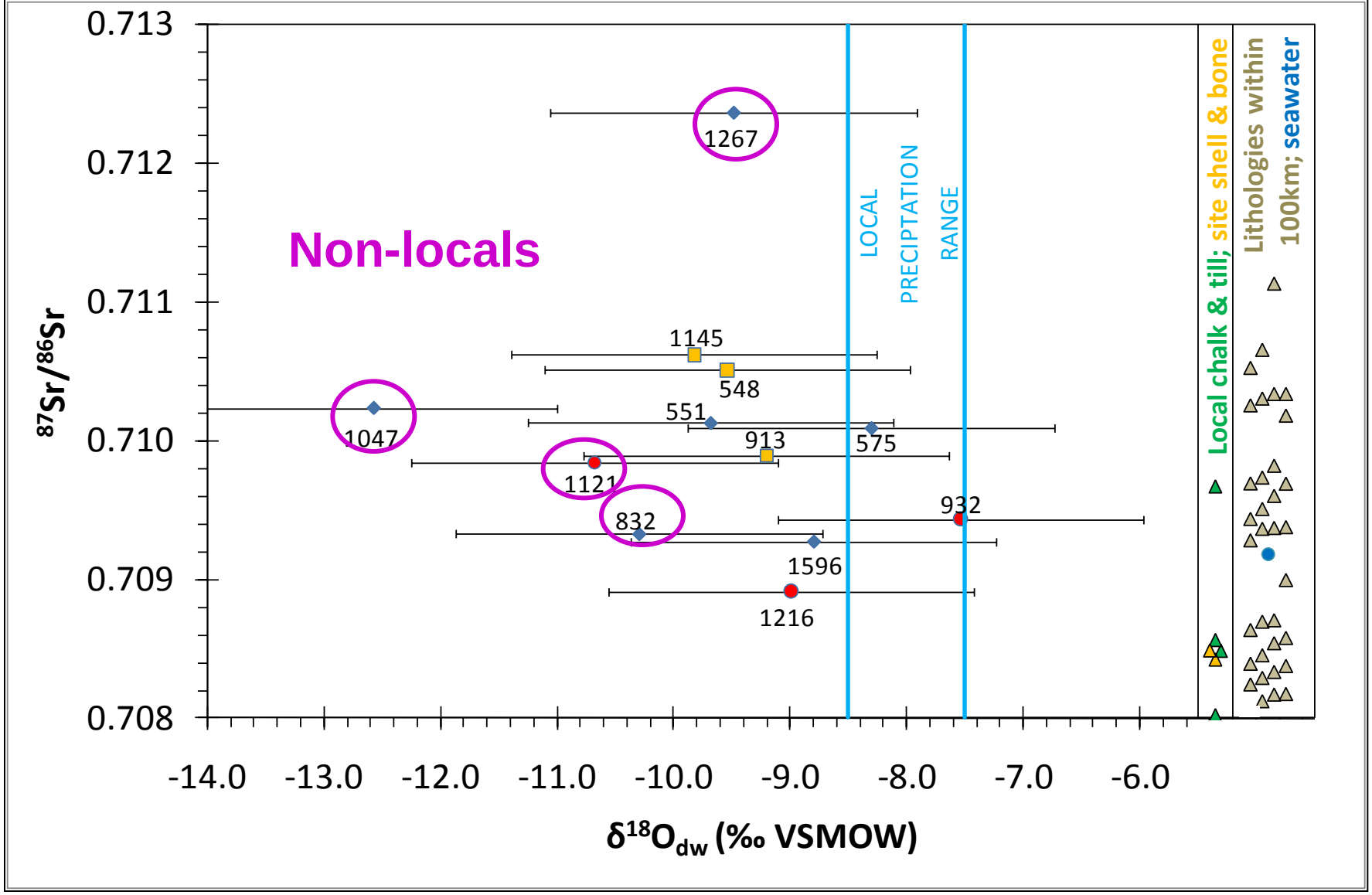


(Mitchell & Millard 2009

Oxygen

Drinking water





Eastern Europe, Scandinavia; east of Baltic Sea; Wales/Scotland

Roberts et al 2012 *American J Physical Anthropology* 150:273-285

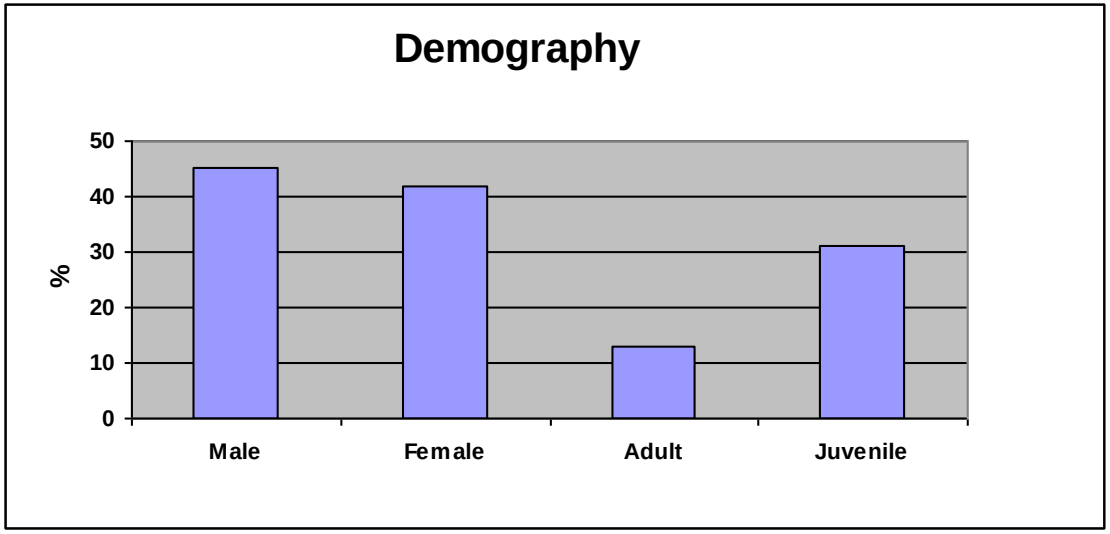
Arts & Humanities Research Council

Migration and health in people buried at the Anglo-Saxon cemetery, Bamburgh Castle, Northumberland

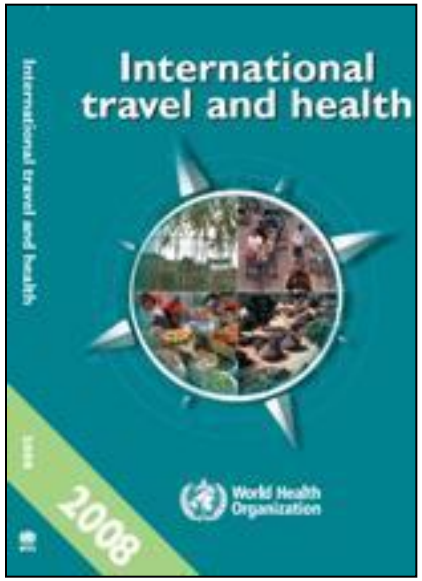
Bamburgh Research Project

91 burials

7th- 9th century AD

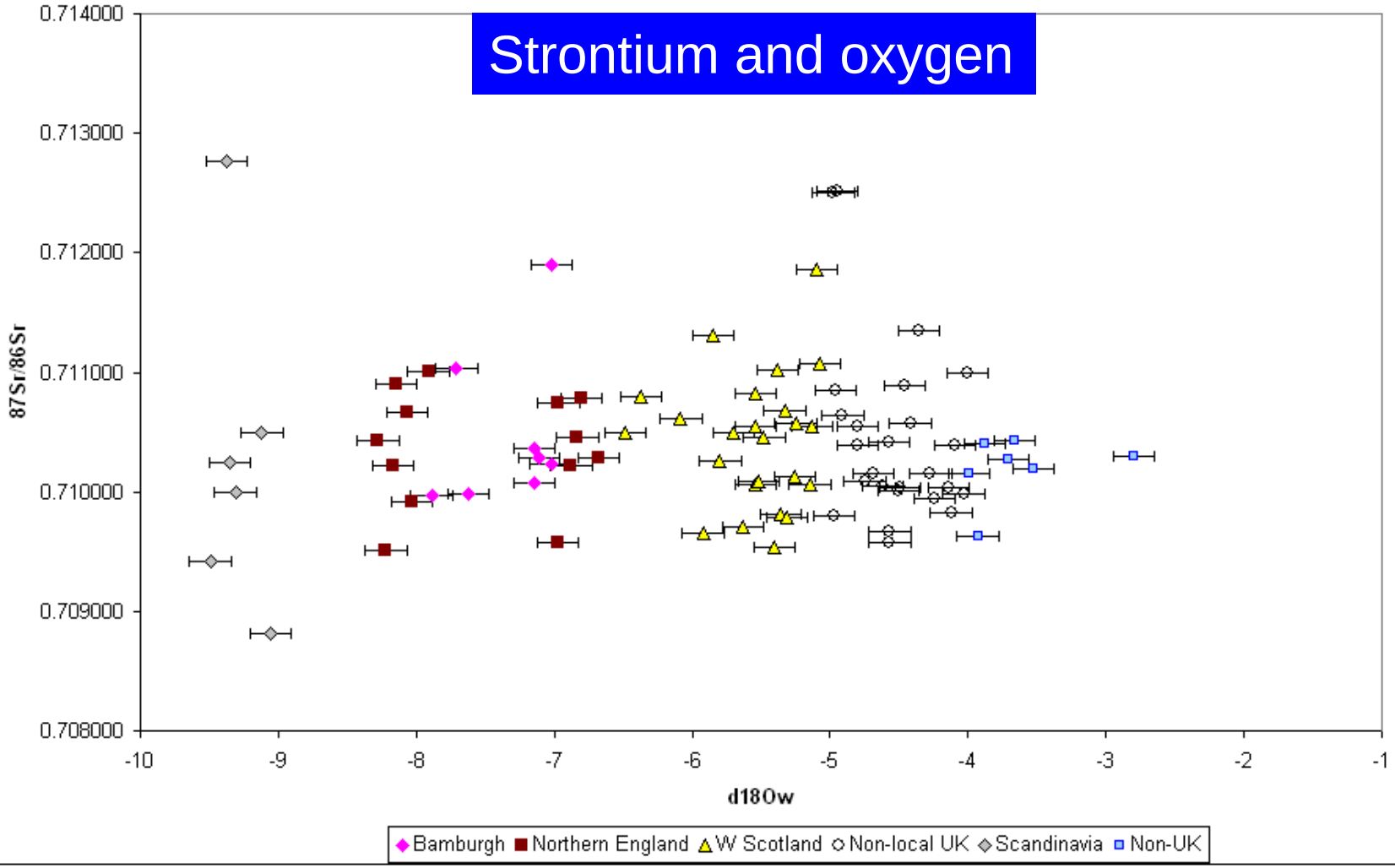


Expectations



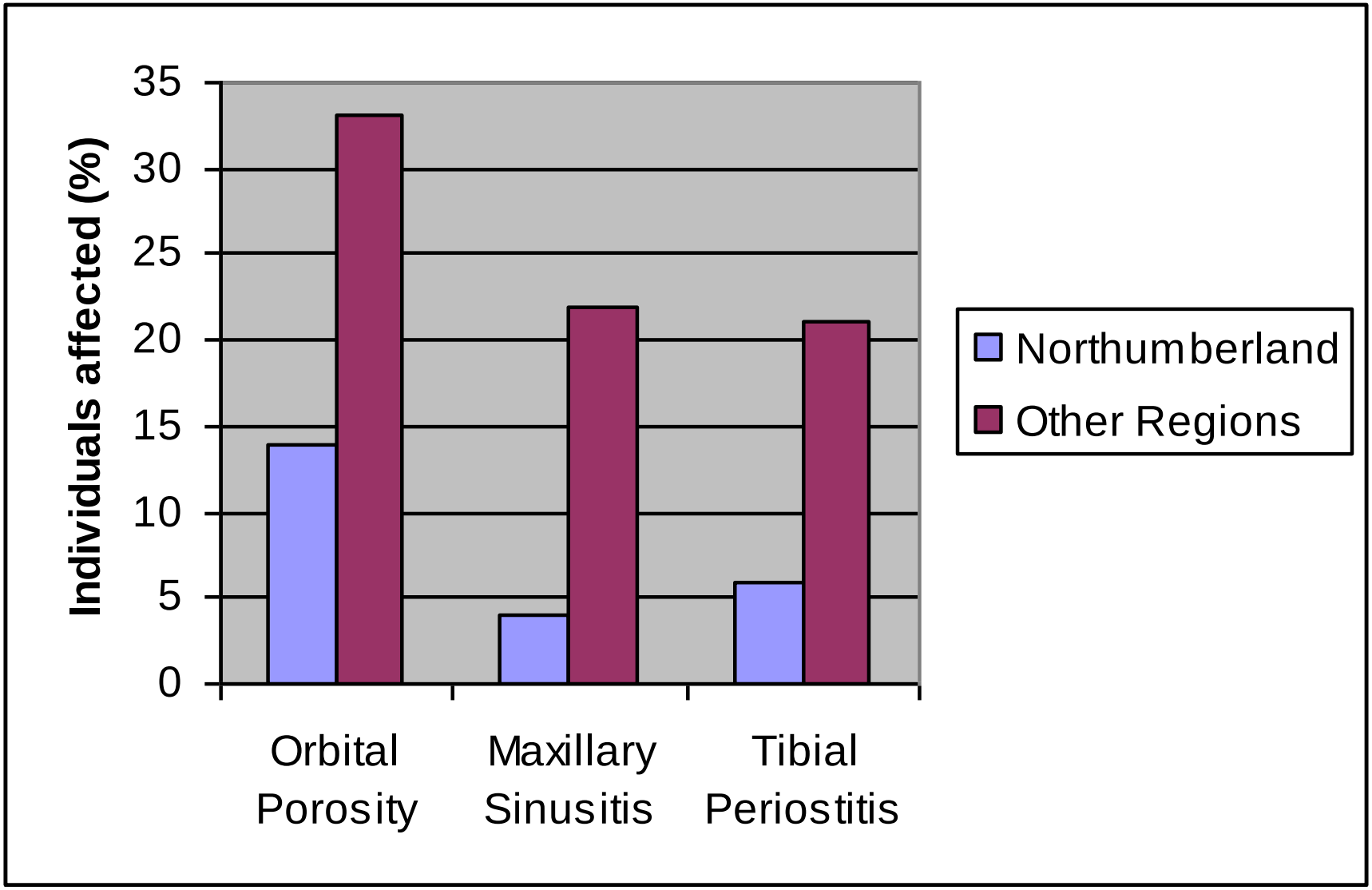
1. There were locally, non-locally, and non-English born and raised people buried here
2. The health of the migrant and the local groups differ

Groves et al 2013 *American J Physical Anthropology* 151: 462-476

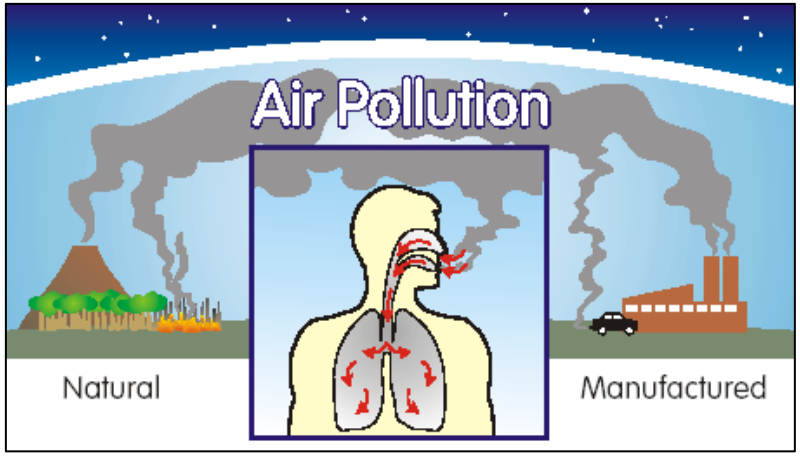


- Over half were non-locally born people
- Scandinavia, southern Mediterranean, North Africa
- There were differences in health between the groups

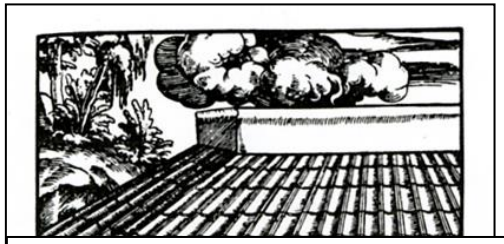
Were locals more or less healthy than non-locals?



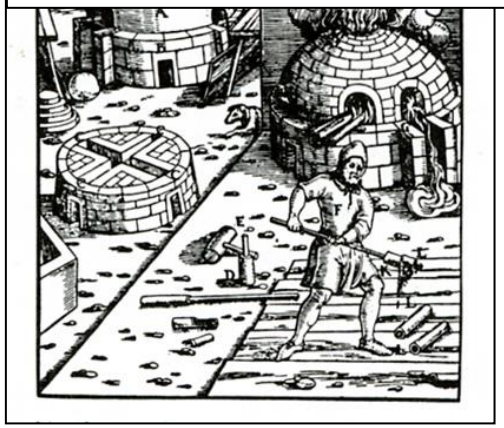
Air quality and health

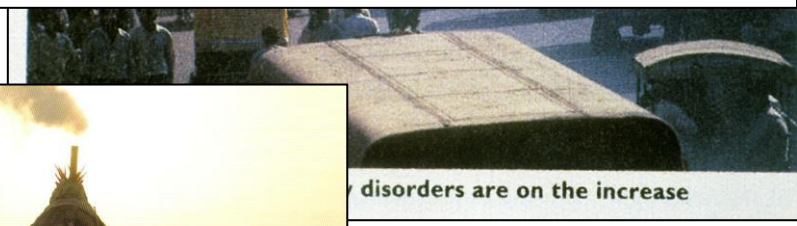


Hippocrates
Ramazzinii



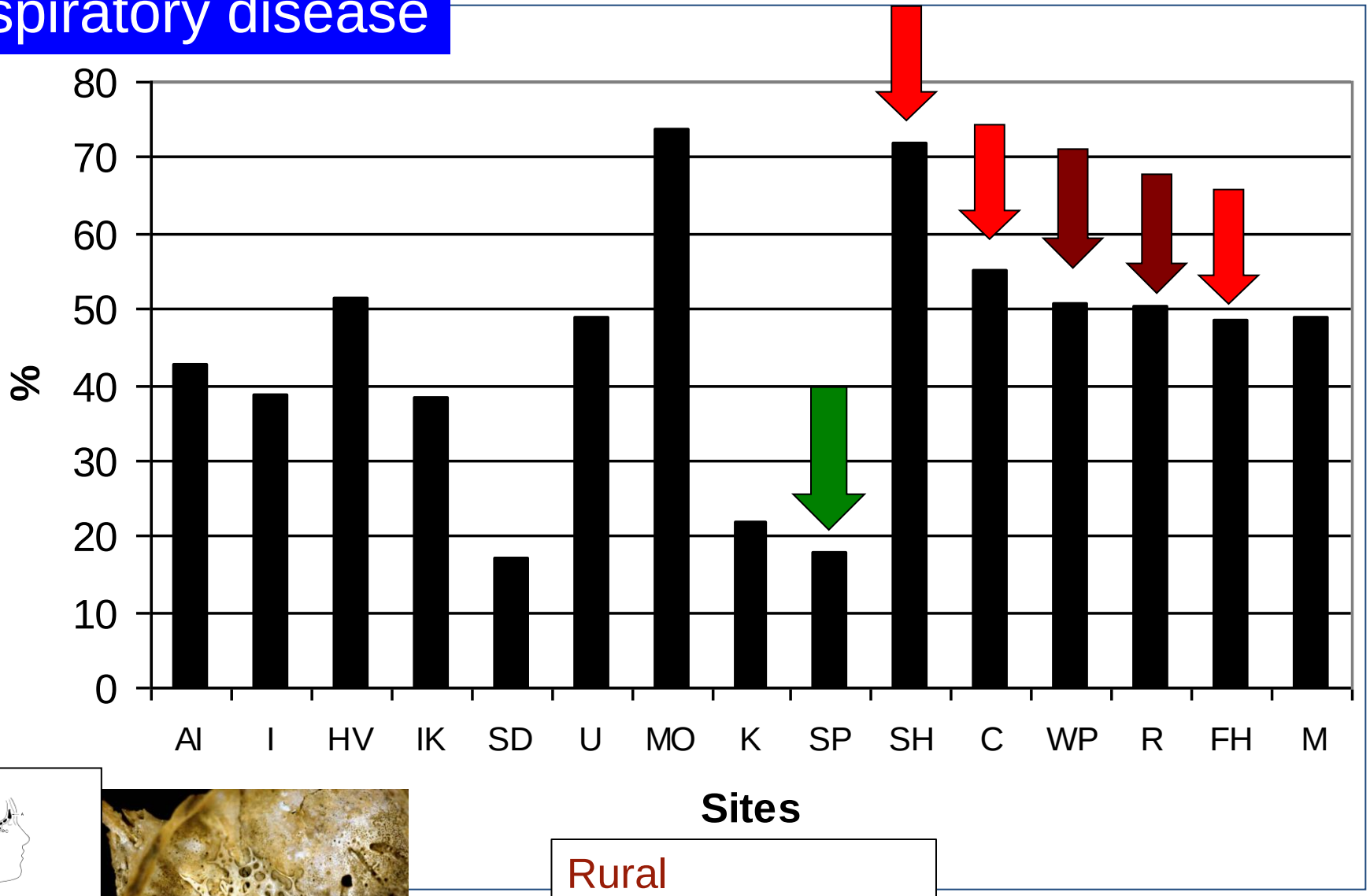
The quality of air that we breathe can affect our health

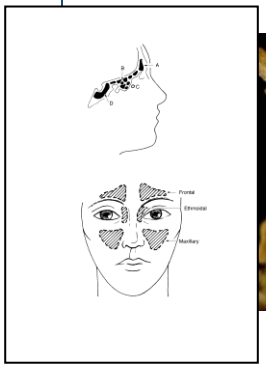


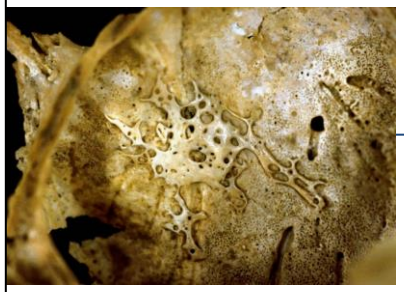


Respiratory disease

Roberts 2007 *American J Physical Anthropology* 133:792-807



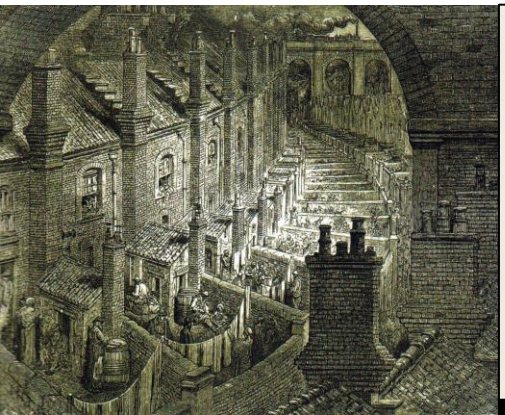


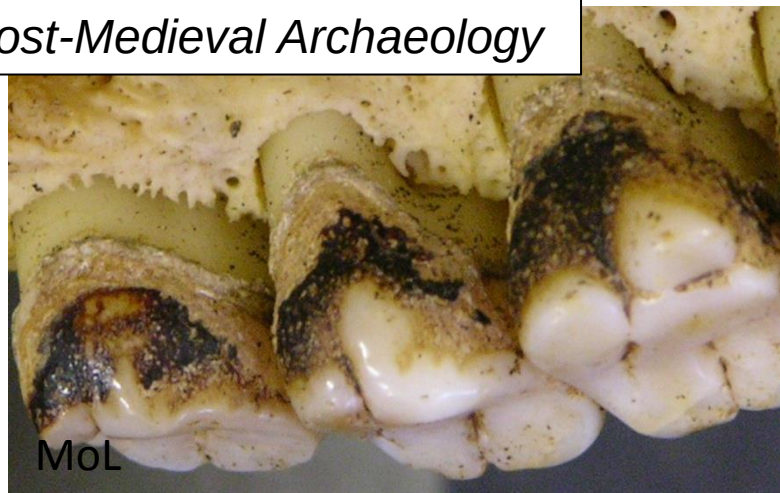


URBAN > RURAL FARMERS >HUNTER-GATHERERS

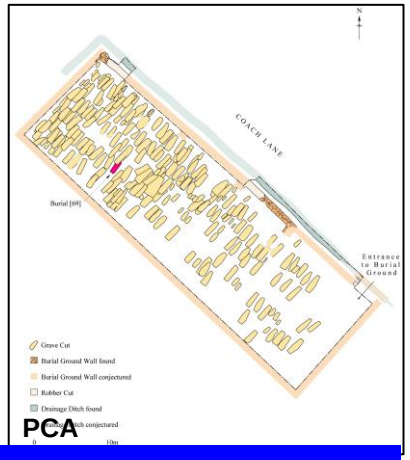
Christchurch, Spitalfields, London – 18th/19th century AD

Walker & Henderson 2010
Post-Medieval Archaeology

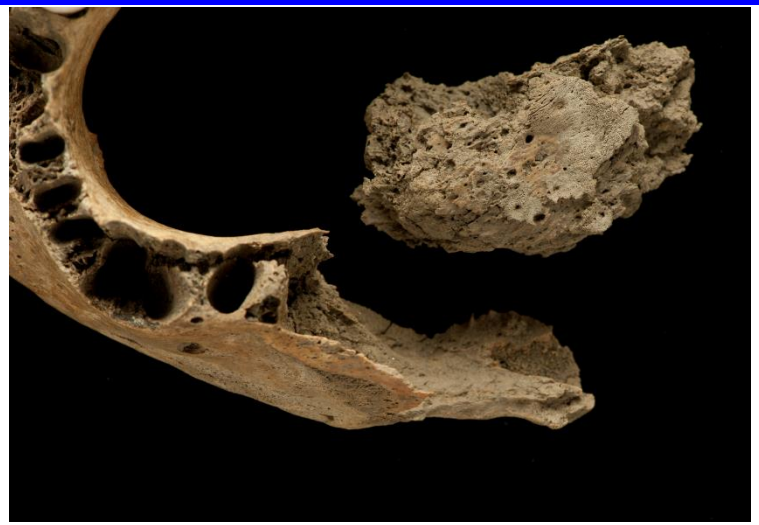




Disease of a worker?



Coach Lane, North Shields, Tyne and Wear, NE England (1711-1857 AD)



12-14 year old

Roberts *et al* in press *Int J Paleopathology*

Possible diagnoses

"Phossy jaw" – working in the matchmaking industry
TB –population density, exposure to contaminated meat and milk, D deficiency
'Respiratory disease" – population density, poor air quality (work/housing/environment)
Smallpox – population density
Actinomycosis - fungal disease
Scurvy (C deficiency) – poor diet
Rickets (D deficiency) – reduced access to UV light (work, housing, clothing)
Infectious joint disease – poor living conditions

Short long bones for age, dental enamel defects: stress during growth

Phossy jaw:
Industrial disease associated with white phosphorus
Side effect of bisphosphonate treatment (cancer/osteoporosis)

Signs and symptoms:
Painful, could lead to blood infection, meningitis & death
Facial swelling, odorous oral discharge

Identity:
Affected the person's identity
Attracted stigma.

This person likely experienced poor living conditions, crowding, compromised air quality, malnourishment, and working long hours, possibly in the matchmaking industry

…….is bright for bioarchaeology

Big questions, big projects, funding
Advanced cutting edge methods (biomolecules)
Multi-method/cross-disciplinary

Ethics and human remains

We must appreciate:

- Ethical issues to studying human remains
- Differ through time and across the world
- How do we know what the dead think?
- Do the dead have rights?
- Can we disturb them for science?
- Human remains are different to other excavated archaeological evidence

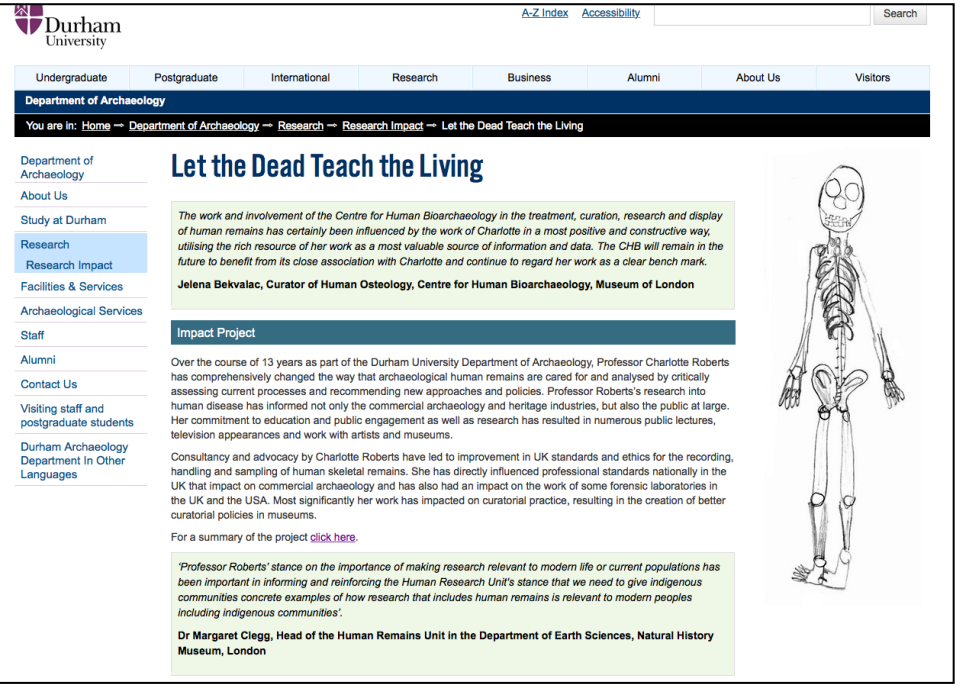

Museum of London

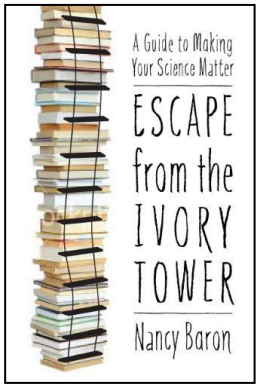
Human remains are curated in museums and universities, and are used for research and teaching

A privilege and not a right
A non-renewable resource

- Provide a professional dedicated environment
- Be respectful of the remains it curates
- Long term curation benefits science

Palaeopathological research: Impact beyond academia





Research with direct relevance to commerce, industry, the public and voluntary sectors

Summary

Palaeopathology:

- Is a multidisciplinary, multi-method questions driven discipline
- inherently considers the impact of the environment on human health

Future:

- More DNA and isotope analyses
- Big picture/datasets
- Ambitious questions
- Contributions to understanding health today/planning for the future health of society
- Ethical issues are important