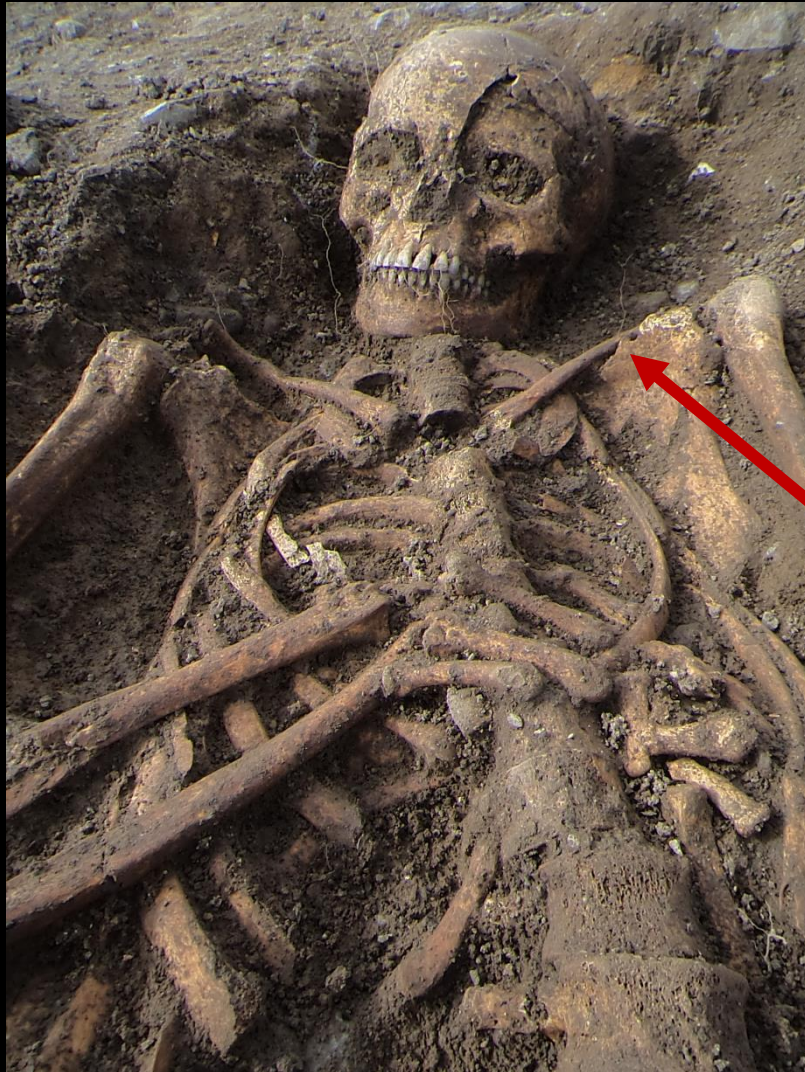




Life and Death in Medieval Ireland: Insights from Palaeopathology

Prof Eileen Murphy

Scientific Analysis of Skeletons



Putting flesh back on the bones of the skeletons – health, diet, lifestyle, violence, emotion, religion, population movement, evolution of infection disease



Ethics of Analysis

- Archaeologists only disturb the dead when v good reason to do so – Usually development – highly regulated system with licences for destructive analysis
- We give a voice to the people of the past and tell their stories
- We cannot understand the present, and prepare for the future, if we do not learn from the past ... including knowledge of diseases and their evolution



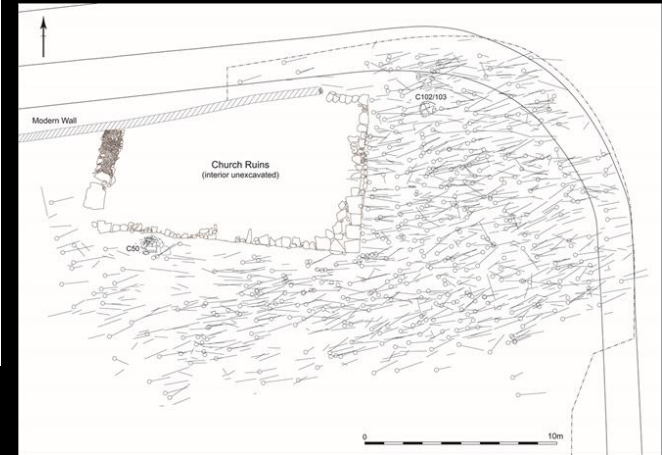
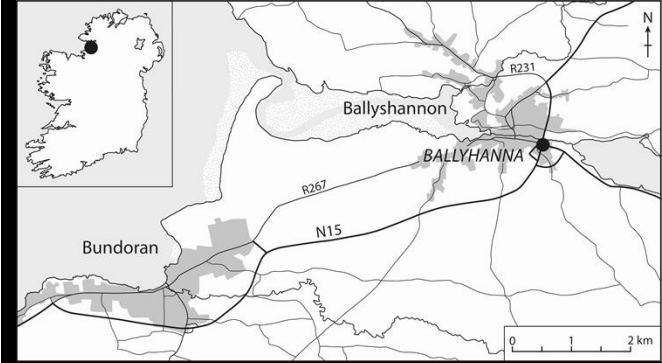
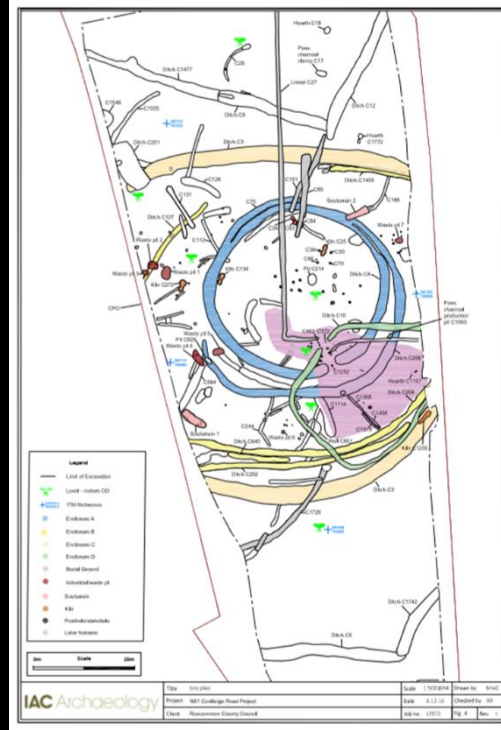
Categories of disease

- Metabolic disease
- Congenital or developmental disease
- Degenerative disease
- Neoplastic disease
- Trauma
- Infectious disease
- Dental disease



Ranelagh & Ballyhanna

Largely Gaelic Medieval populations



Road project

- Funder – Roscommon CC, Transport Infrastructure Ireland
- 557 individuals – 170 adults & 387 children



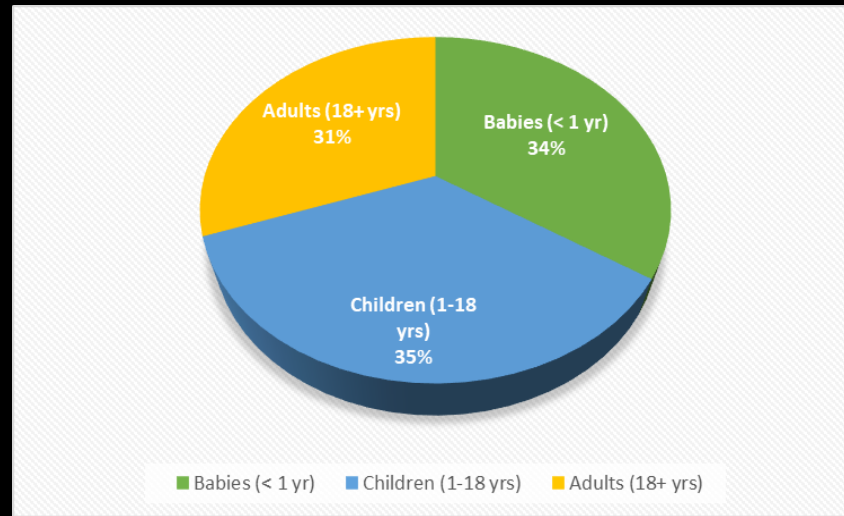
Main burial phase:
mid 6th – early 14th century

Mostly typical Christian burials – extended, supine, head to the west.

Road project

- Funder – Donegal CC, National Roads Authority
- Main burial phase: AD 1200 – 1650
- 1296 individuals – 869 adults & 427 children

Ranelagh Population profile



557 individuals

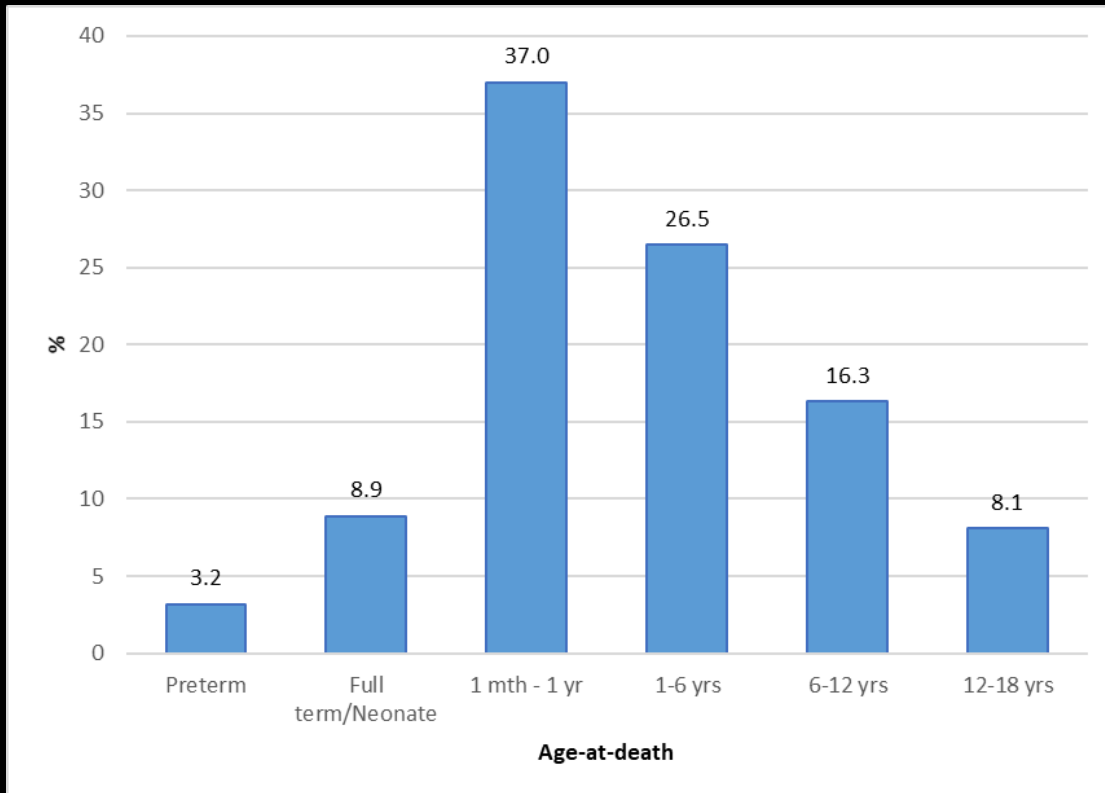
- 191 babies
- 196 children
- 170 adults



Ranelagh

Juvenile demography

- Total number of juvenile skeletons: 387 (69.5%)



Babies (< 1 year) – 191

Children (1-18 years) – 196

Sk 190 (1-3.5 yrs)

Sk 192 (1.5-2.5 yrs)



Pregnant women and unborn babies

Modern maternal deaths in developing countries – haemorrhage, hypertensive disorders and eclampsia, sepsis/infection, obstructed labour and unsafe abortions



Mother – 17-22 yrs
Baby – 38 wks
Oblique lie – head down



Mother – YA
Male baby – 38 wks
Head down

aDNA – Sk 112 no relatives in the aDNA dataset.
Baby – c. 3 relatives.



Preterm and neonates



TWINS

Sk 453 – 38 gest wks
Sk 455 – 38 gest wks



Hands overlapped or entwined

12 preterm infants – all died during the third trimester of pregnancy (28-40 gestational weeks).

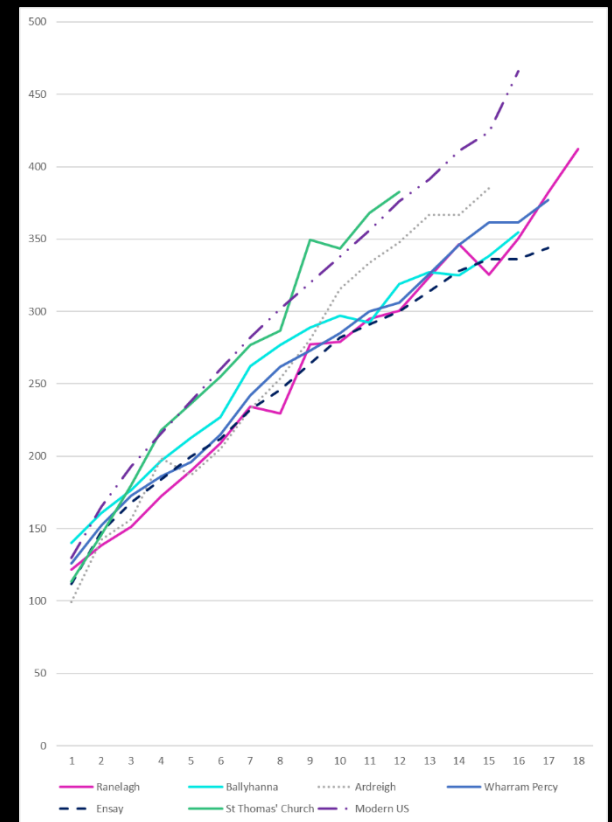
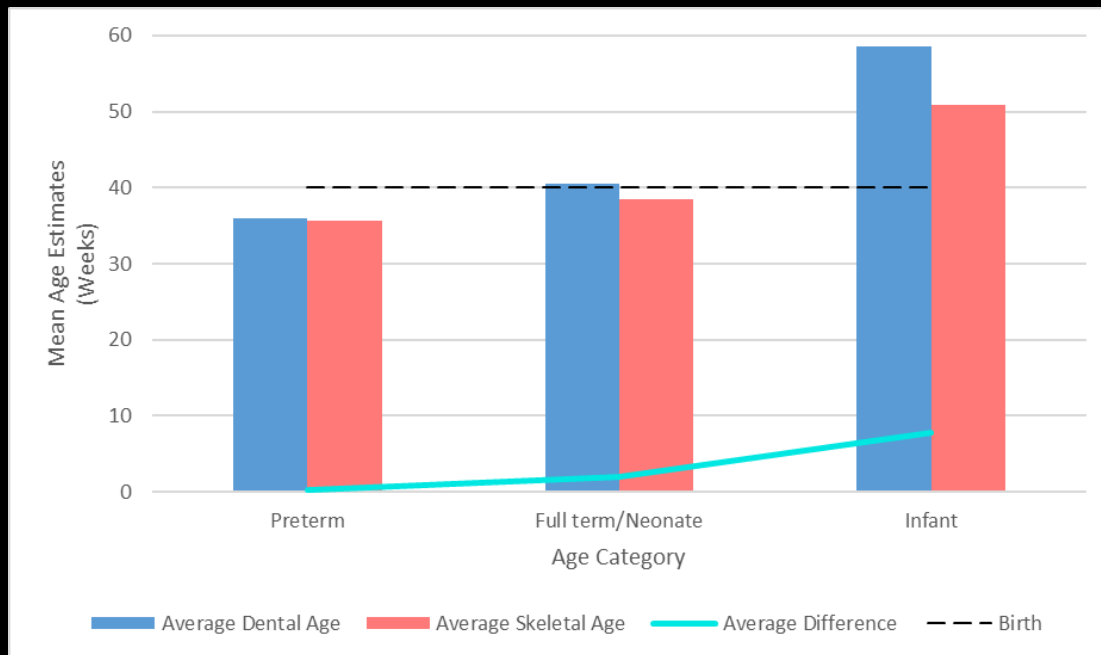
Youngest preterm baby had died at 29 gestational weeks (c 7 months)

34 full term/neonatal babies

Mothers presumably survived

Ranelagh - Population Stress

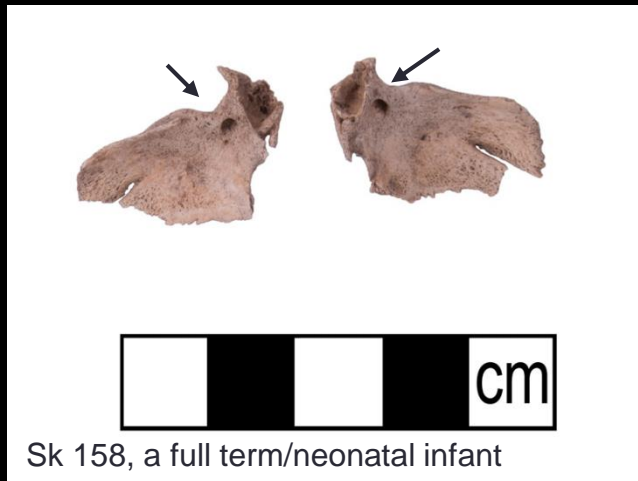
- The babies at Ranelagh displayed a high proportion of stunted growth - age estimations based on dentition were older than those based on long bone lengths (84.7%; 94/111).
- Infants of 1 month to 1 year of age most affected – a difference between dental and skeletal age for infants of 7.5 weeks.
- 1-5 yr olds from Ranelagh smaller than those in all of the comparator Medieval and Early Modern populations
- After the age of five years they appear to catch up and a greater degree of overlap is evident with the other Medieval populations.
- Babies and very young children were particularly physiologically stressed in the Ranelagh population.



Signs of stress in infants & YC also evident in dentine incremental isotopes

Ranelagh - Vitamin C & Vitamin D deficiency

- 37.2% (71/191) babies – Lesions suggestive of rickets and/or scurvy - Malnutrition and/or lack of sunlight
- Natural disasters that impacted on food supplies, such as crop or animal disease, or environmental events that killed or damaged livestock or plants, including extreme weather events are likely to have put past populations at risk of malnourishment.
- *The Annals of Ulster* - AD 764 as a year of excessive snowfall, drought and famine. It was recorded that dysentery flourished, presumably because of the malnourished state of the people and that the young, old and the weak were particularly vulnerable (Kelly 1997, 354).



Sk 158, a full term/neonatal infant



Did malnourished mothers have vit C deficient babies? Modern literature suggests not but ... Dr Norris Wilkinson (1921) - scurvy in a purely breast-fed baby of a few months of age. He described the mother as a 'strong, stout, healthy country woman' and blamed her diet of pickles, vinegar and bread as the cause of the baby's condition. He reported that a change to the woman's diet caused the baby to recover.

Rickets

If inclement weather a cause of famine (Annals)

Did mothers keep their infants indoors to protect them?



Sk 527

c. 7.5 months

- Flattened epiphyses
- Angling of epiphyses
- Poor quality bone
- New bone formation
- Cupping and fraying of sternal ribs



Rickets - Children

Rickets Vitamin D deficiency
12 possible cases in children (12/190, 6.3%)



Bending deformity of the left humerus (lateral view) of Sk 493 (16.5-19.5 yrs)



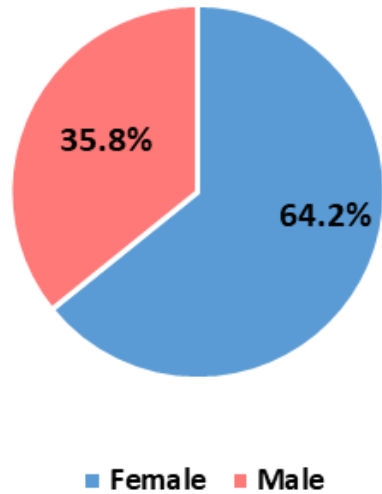
Bending deformity of the right tibia (anterior view) and flaring of right femur (posterior view) of Sk 489 (2-2.5 yrs)



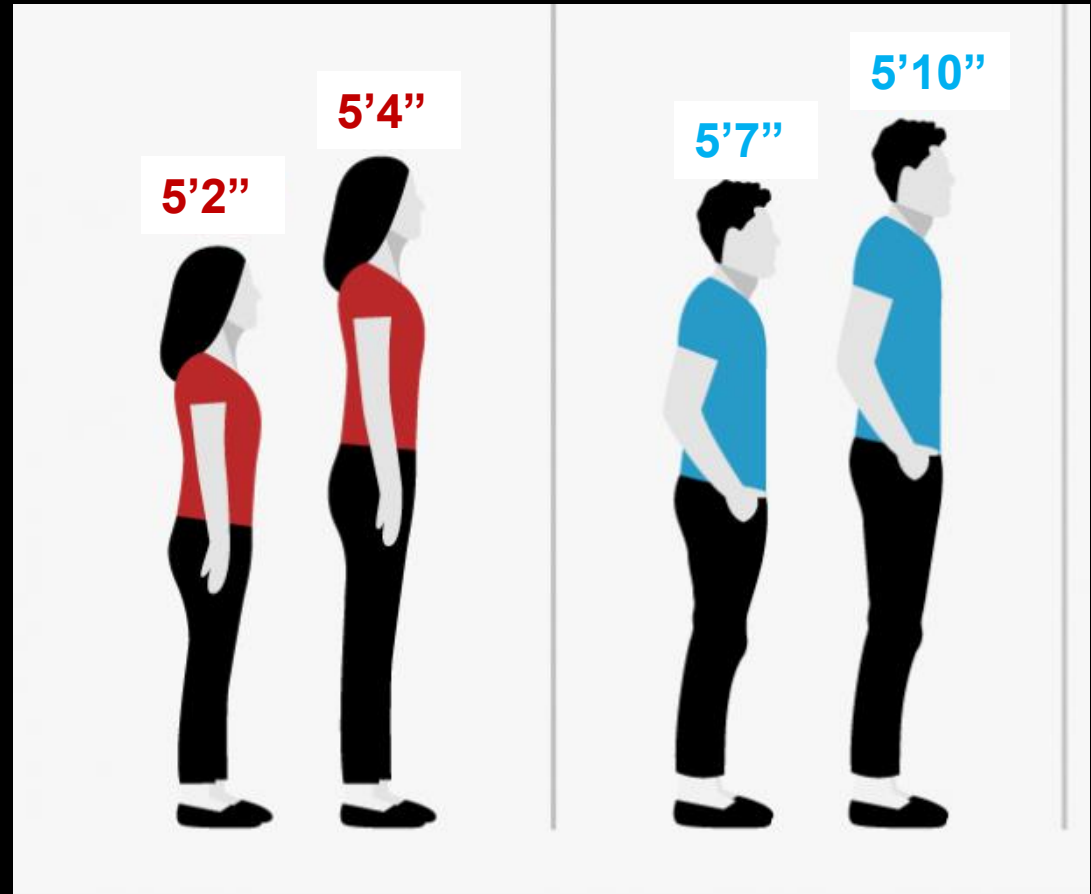
Twisting deformation of the tibiae (posterior view) in Sk 318 (15.5-20 yrs)

Ranelagh Adults

Adult Sex Determination

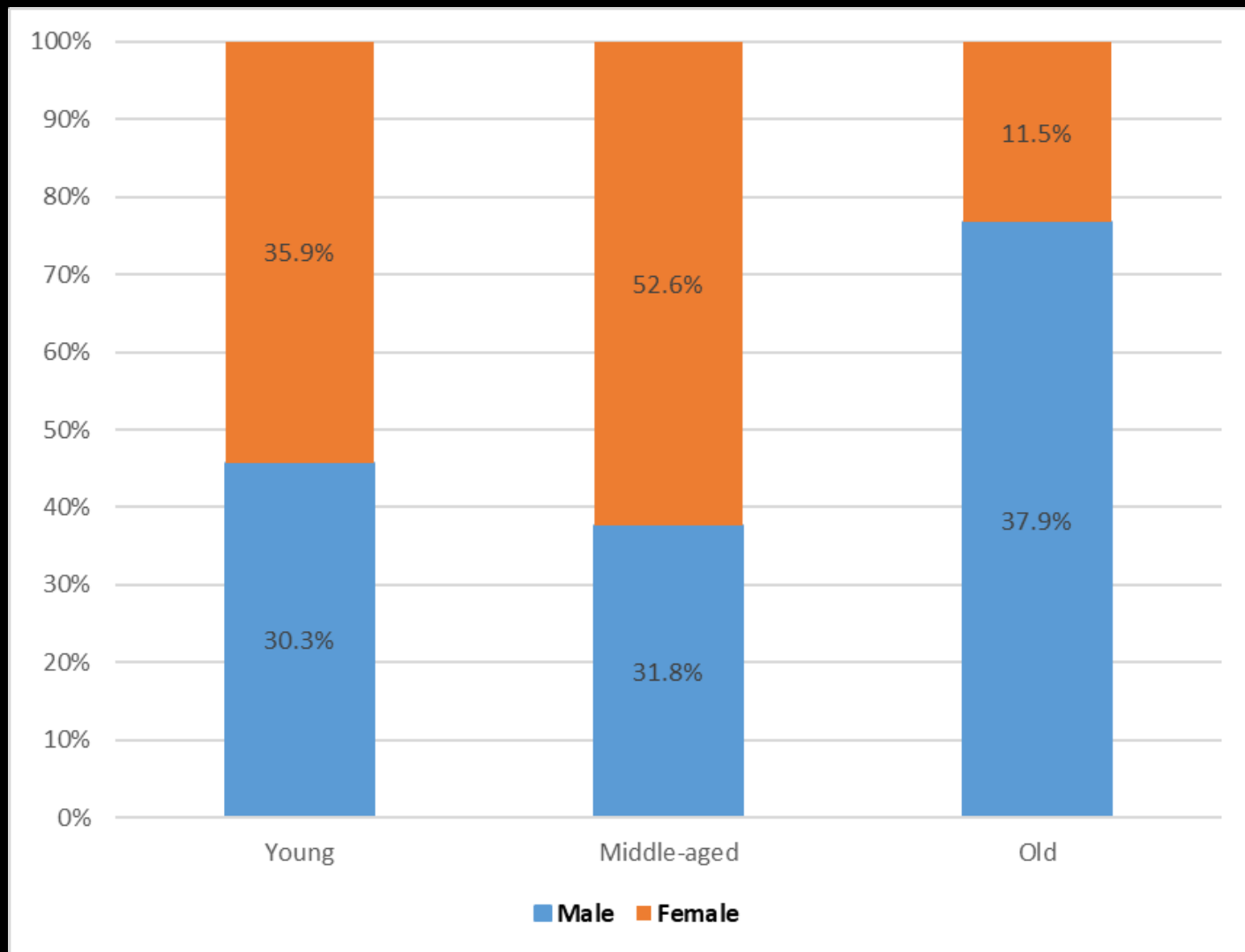


- 167 adults – women c. 2/3: men 1/3 – unusual profile since usually 50:50



Average height of Ranelagh vs Modern Irish adults

Ranelagh Adult Demographics



- Largest proportion = Middle-aged (43.1%), but younger (33.3%) and older adults (23.6%) well represented

Ranelagh Indicators of an Arduous Life – degenerative joint disease



- Almost all adults had osteoarthritis in some part of the body

Includes Young Adults so suggests arduous lifestyle from a young age



Ranelagh Injuries

- 46 adults (c. 22%) displayed minor injuries
- More serious included fractured ribs, 2 hip fractures, a fractured elbow and several finger fractures/injuries.
- Farming lifestyle.



Sk 6, OA Female.
Long standing hip fracture

Also had extensive osteoarthritis

Possible Type II Osteoporosis

Sk 67, OA male.
Long standing hip fracture



Also had fractured tibia

Possible heavy fall

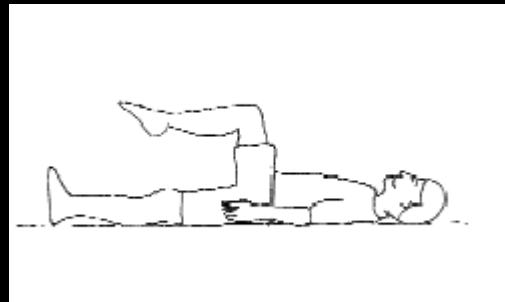


Sk 187, MA male. Rib in early stage of healing

Ballyhanna – Serious traumatic injury



Sk 606
Male 30-40 yrs



Long term physical impairment. Individual probably bed-ridden for a minimum of 2-3 months while hip fracture was healing.

Fracture-dislocation at the left hip joint,

- femoral head has moved medially and anteriorly bursting through the obturator foramen.
- Deformity would have resulted in permanent flexion of the left leg at approximately 90° during life.
- Possible individual was largely immobile following the injury. Gracile bones – atrophy?.

Ranelagh – Weapon trauma

- 6 cases of weapon trauma – 5 adults and 1 child
- All male
- Adults - 18-35/35-50 years
- All robust
- 5 decapitations



Drawing of Irish warriors using battle axes (13th c. Giraldus Cambrensis)



AD 688-885 (2 σ)



Sk 290

Ranelagh – child decapitation

Sk 449

Older male child (7.5-9.5 yrs)

- Sharp cut lesions in the mandible and three cervical vertebrae
- Adjacent to large stone pit
- AD 774-987 (2 σ)



Prevalence violent death = 3%
Similar to other EM sites except Owenbristy (17.9%)

Ballyhanna Trepanation



- At least 106 holy wells in Donegal
- 8 wells in vicinity of Ballyshannon

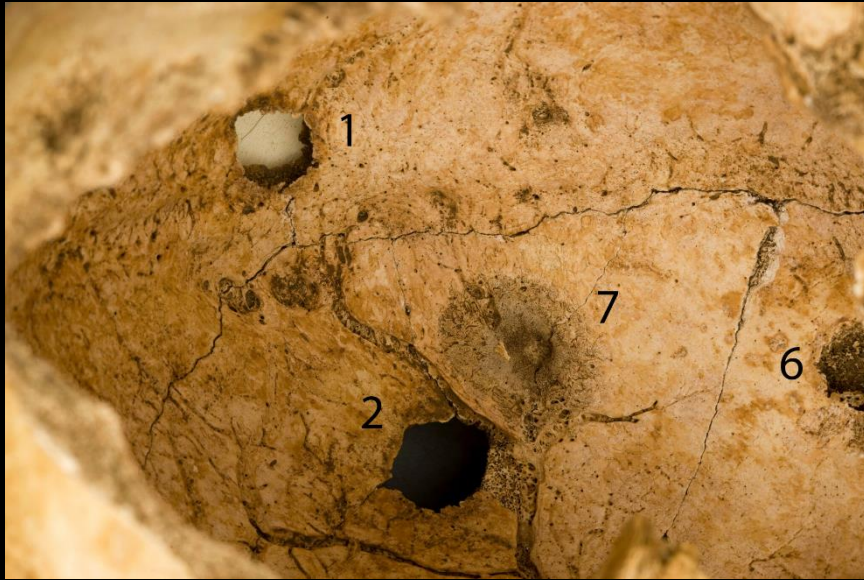


Trepanation with healing in Sk 1242 - Woman, 18-35 yrs AD 7th/8th century

Severe chronic osteomyelitis in the L femur and 3rd and 4th lumbar vertebrae
- Which came first, trepanation or infection?



Ballyhanna - Metastatic carcinoma



Sk 671, 18-35 yrs, Female

- 9 focal osteolytic lesions
- Only skull preserved
- Lytic lesions – primary tumour in the breast (57-73%) or lung (19-32%)
- Metastases associated with breast cancer?
- Differential diagnosis – multiple myeloma but reactive bone formation not found in latter
- Untreated breast cancer - Mean duration of life from the onset of symptoms was 3 years, with only 18% surviving for five years or more (Bloom et al. 1962 – 250 patients)



Ranelagh - Tuberculosis

TB was a problem - 5 children and 3 adults – higher levels than comparator sites (2.5% as opposed to c. 0.8%)
Possible brucellosis, one systemic infection, but most infections were minor isolated cases in a bone.



Sk 291

Adolescent (16.5-19.5 yrs)

- Dental enamel hypoplasia
- Heavy calculus
- Bone swelling and lytic lesions in the left ulna and ribs
- Periosteal new bone formation



AD 769-950 (2 σ)

Ranelagh - Tuberculosis



Sk 18 – Female teenager with cystic tuberculosis AD 1045-1272 (2 σ)

Sk 379 – YA female with tuberculosis AD 649-767 (2 σ)

Leprosy in Ireland

OUTCASTS,

or care in the community?

Lauren Buckley on leprosy in Hiberno-Rome Dublin

2008

ARMOY EXCAVATIONS

'Be Thou Dead to The World': Leprosy in Ireland, evidence from Armoyn, Co. Antrim



Following examination of one of the skeletons from the Armoyn excavations EILEEN MURPHY and KEITH MANCHESTER present the background to one of the nastiest physical and social diseases to afflict mankind.

Leprosy hospitals built in Britain in the twelfth and thirteenth centuries, followed by a notable decline, so that by the fifteenth and sixteenth centuries very few new foundations were recorded. The disappearance of leprosy as an endemic disease in Europe by the sixteenth century has been attributed to the emergence of tuberculosis caused by *Mycobacterium tuberculosis*, a bacillus closely related to *Mycobacterium leprae*, which causes leprosy. It has been suggested that *Mycobacterium tuberculosis* is more virulent than its relative, and that leprosy was forced into a decline during the late medieval period as tuberculosis increased in prevalence.

In spring 1997 excavations took place inside St Patrick's church at Armoyn, Co. Antrim, under the direction of Declan Harf of the Environment & Heritage Service. The lower layers contained the remains of 56 individuals of all ages and both sexes. Originally an Early Christian foundation, we do not know when the medieval church fell into decline but the Ordnance Survey Memoirs of 1838 record that 'the old church was destroyed by the accumulation of graves that had been formed about the windows and doors of it', which suggests that people had been burying their dead in and around the church for

LEPROSY IS A DISEASE of great antiquity; the earliest documentary reference is found in the *Sukrawa Samhita*, an Indian manuscript dating from approximately 600 BC. The first palaeopathological evidence for leprosy from an archaeological context was discovered at the second-century BC Dakkilihi Oasis in Egypt, while the earliest European evidence

was found among Romano-British skeletons dating from around AD 400 from Poadbury in England. It would seem, however, that leprosy was not common in Europe until later in the medieval period; the growth and decline of leprosy hospitals are thought to reflect the prevalence of the disease in society. There was a great increase in the number of

Page 12

1998



Living in Ireland in 2008 we are fortunate daily with extensive scientific coverage of the work of the Health Service—free lack of hospital bills, wide of care and support to the treatment of new and long-established chronic. Analysis of remains from nearly a thousand years ago in what was then the western periphery of Dublin seems to remind us that these problems are nothing new.

In 2005 Dr O'Donovan of Margate County and Co. Ltd excavated the edge of the graveyard of the church of St Michael for St. An Gildas. Last October, in a series of excavations by Margate Development Ltd. The excavation allowed a rare opportunity to analyse a statistically significant section of the population at a time of growth and transition.

Of the 272 individuals recovered, one of the burials, individualised to the obvious, early AD, showed direct evidence for the advanced stages of leprosy but other skeletons showed bone changes associated with leprosy although the diagnosis is not absolutely certain. Leprosy is still a most feared and dreaded disease, and the new report is charged with sensitive meaning. It is associated with great disengagement and mutilation of the limbs and was thought to be so contagious that at one time, widows were regarded as the scourge of their communities.

Myths and misinformation about the disease abound but it is not surprising, as many reports disagree about various aspects of the illness, including the history and degree of contagion.

History

Although leprosy is mentioned several times in the Bible, these references are thought to be misinterpretations of the Hebrew word for 'leprosy'. It seems to have been established in China in the first millennium BC, and there are also early written references to it in Indian medical texts from c. 600 BC. The general consensus is that it was brought to the Mediterranean basin by the Phoenicians and north-west India by the seafaring Greeks of the classical period. The disease followed a similar pattern in southern Scandinavia, although its northern Scandinavia and Ireland is preserved until the nineteenth century.

What is leprosy?

Leprosy is an infection caused by *Mycobacterium leprae*. Transmission of the organism from an infected human host to another host occurs rarely, but the disease occurs in less than half the people exposed to the bacteria. Individual response to any disease varies, and there are many examples of individuals working and living in leprosy colonies for years without exhibiting symptoms.



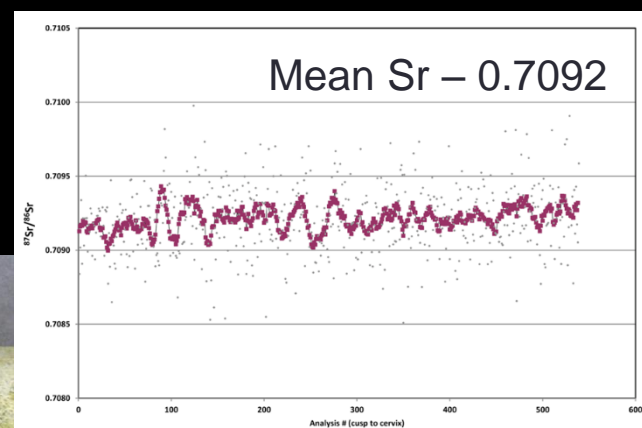
- AD 1445-1637 (2 σ)
- Leprosy evoked great fear
- Sufferers thought to have been immoral and punished by god
- Excluded from society
- 'Be thou dead to the world'

- Osteoarchaeology
- Ancient DNA
- Strontium & Oxygen Stable Isotopes
- Archaeological & Historical Context

Sk CXLVIII (148)



Lesions of the feet – leprosy
Also infection at ankles & wrists



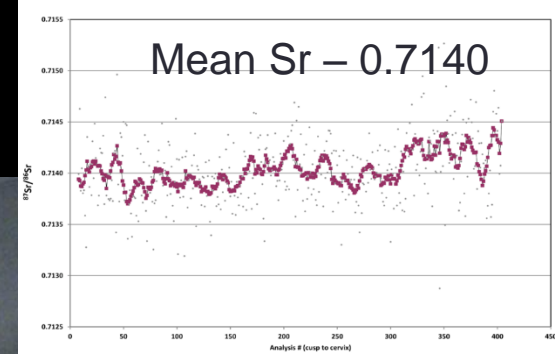
- Strontium 0.7090- 0.7095
Oxygen -9‰
- Geographic areas = vale of York, central Europe, Denmark and southern Sweden
- Possible Scandinavian origin (2-5-8.5 yrs of age)

Probable male
13-18 yrs
Atypical burial position
AD 939-1030 (2σ)

Site	Context	Element	Sample (mg)	RLEP PCR EVA Green™	RLEP PCR FAM Probe	18-kDa PCR JOE Probe
Golden Lane	SkCCL	Rib	80	-	-	ND
	SkCXLVIII	Distal fibula	80	±	-	-

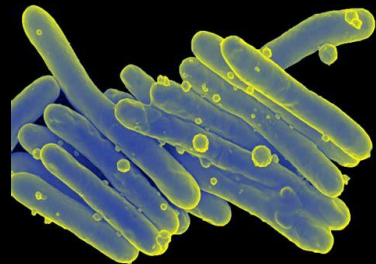
Weak positive for leprosy – DNA too fragmented for further work

Sk CXCV (195)



- Strontium (high = Scandinavia)
Oxygen -6‰ (low for Scandinavia)
- Coastal southern Norway - oxygen values less than -7‰ (2-5-8.5 yrs of age)

Facial lesions – destruction of palate, inferior nasal
Lesions of the feet and ankles



V well preserved DNA
Genomic analysis
Type 3I-1

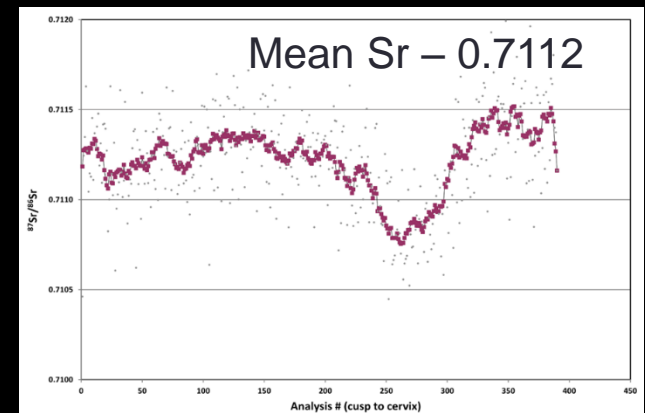
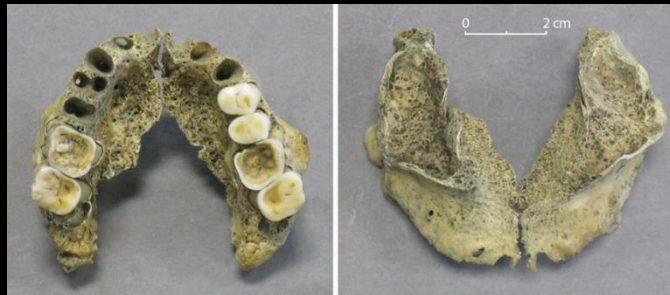
Man 35-50 yrs
Typical Christian burial
AD 1152-1260 (2σ)

Locus: TN positio ¹	SkCXCV	Inference
SNP 1: 14,676	C	
SNP 2: 1,642,875	T	
SNP 3: 2,935,685	C	Main type 3
SNP 4: 413,903	G	Subtypes I-K
SNP 5: 591,857	C	Subtypes I-L
SNP 6: 1,133,492	T	Subtype I
SNP 7: 2,312,066	C	Subtypes I or J
SNP 8: 7,614	T	Subtype I
SNP 9: 1,113,923	G	Main type 3
SNP 10: 1,104,235	ND	
SNP 11: 3,102,787	ND	
Indel 17915	1 copy	3I
11 bp repeat		
SNP 12: 1,527,056	G	2I-1
Genotyping		3I-1

Sk CCXXX (230)



Facial lesions – perforated palate
 Ulcer on forehead
 Minor lesions in feet and ankles



- Oxygen – Ireland (-5.5‰)
- Strontium - parts of northern Ireland, eastern Wales and British midlands (8.5-13.5 yrs of age)

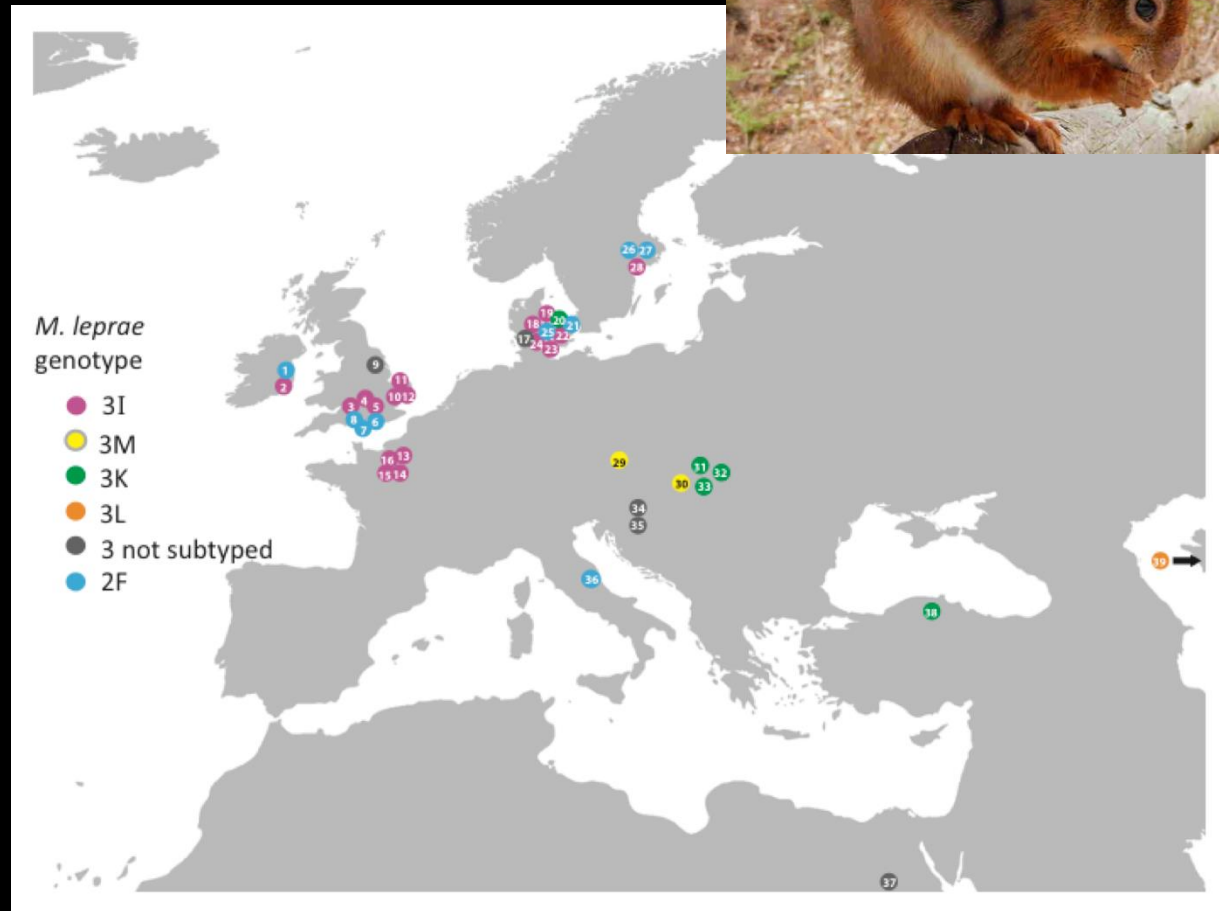
Locus: TN position ¹	SkCCXXX	Inference
SNP 1: 14,676	C	
SNP 2: 1,642,875	T	
SNP 3: 2,935,685	A	Main type 2
SNP 4: 413,903	G	Subtypes E-H
SNP 5: 591,857	Inference	Subtypes E-H
SNP 6: 1,133,492	T	Subtypes E-H
SNP 7: 2,312,066	C	Subtypes E-H
SNP 8: 7,614	C	Main types 1-4
SNP 9: 1,113,923	A	Main types 1,2 or 4
SNP 10: 1,104,235	C	Subtypes E or F
SNP 11: 3,102,787	C	Subtypes F-H
Indel 17915	2 copies	Not 3I
11 bp repeat		
SNP 12: 1,527,056	G	
Genotyping		2F

Man 35-50 yrs
 Typical Christian burial
 (ear muffs)
 AD 1039-1219 (2σ)

V well preserved DNA
 Genomic analysis
 Type 2F

Significance – Epidemiology of Leprosy

- Two separate branches of the leprosy phylogenetic tree.
- 2 strains co-existed in 12-13th century Dublin
- Type 3I – Scandinavian origin. Found in modern red squirrels! – did fur trade contribute to spread in Medieval times?
- Type 2F - migrated from the Middle East to India and South-East Asia, then evolving to Type 1 strains. Present-day locations of this genotype include Turkey and Iran.



Dublin & Ireland well connected in Medieval times

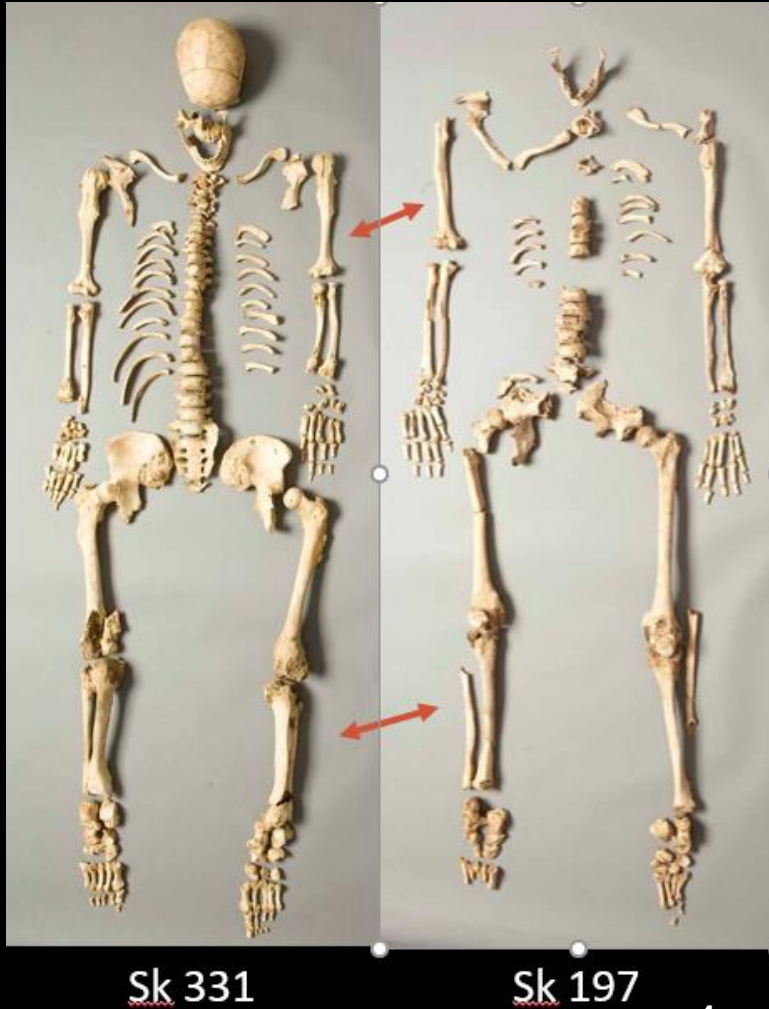
How did the disease get to Ireland? Viking legacy?



- Sr and O isotopes – 2 Scandinavians and 1 NI/GB individual
- We know Vikings arrived in Dublin in AD 840s
- Did they bring more than towns, currency, etc. to Ireland?
- Did they bring Leprosy too????

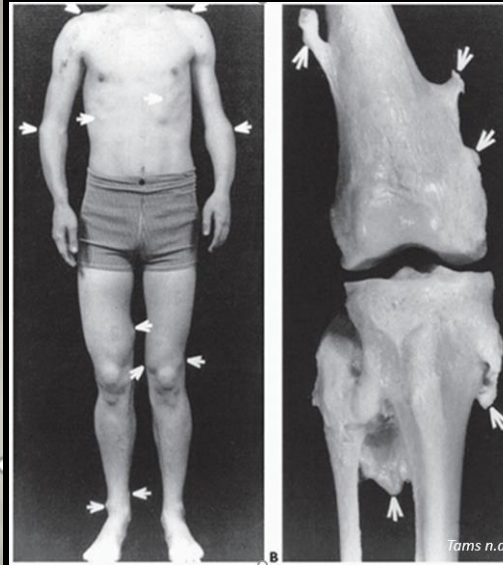
Genetic - Major Physical Impairments

Ballyhanna – Multiple Osteochondromas



Sk 331

Sk 197



- Modern Whites – 0.9-2 people per 100,000
- Chamorros of Guam – 100 per 100,000
- Pauiungassi, Manitoba, Canada – 1,310 per 100,000

4 archaeological cases in Ireland

Disproportionate short stature . Limb-length discrepancies . Forearm deformities . Coxa vara of the femora . Valgus deformities of the knees and ankles . Asymmetry of the pectoral and pelvic girdles . Shortening of the hand bones



The Road Less Traveled: Niall's Musings



Tag Archives: *Multiple Osteochondromas*

Hereditary Multiple Exostoses (HME) and Me

BALLYHANNA MAN - EARLY EVIDENCE OF HEREDITARY MULTIPLE EXOSTOSES
He occupies pride of place in a specially constructed case at Donegal Museum in Letterkenny, in far-flung rugged North West Ireland, and was a key focus of the Ballyhanna Research Project funded by Ireland's National Funds Authority (NFA) and involving cross-border collaboration between Queen's University Belfast and the Institute of Technology in Sligo.

Dating at least 600 years, from 1100-1400, 'Ballyhanna Man' was one of 1,200 skeletal remains found by archaeologists around a buried church less than 2 miles

south of Ballyhanna, on the banks of the River Erne, in 2006.

And what makes him so interesting is that he is the first intact case of **Hereditary Multiple Exostoses (HME) / Diaphyseal Aclasia** to have emerged in Irish archaeology and one of the very few in the world.



Remains of 800-year-old Ballyhanna (Donegal, Ireland) Man (Skibhainn 331) showing evidence of HME / Osteochondroma.

Research (which is ongoing) evidence so far indicates he was about a young adult of about 25 years old when he died (atypical of the mortality rate of the other non-HME male remains excavated at the burial site). Projecting bone lumps were evident on the upper and lower limbs: Two bones on each lower leg were fused together, and he was knock-kneed. His arms were bow-shaped, with the left arm noticeably shorter.

Officially a 'Rare Disease' –
Inherited autosomal dominant condition
of enchondral bone growth

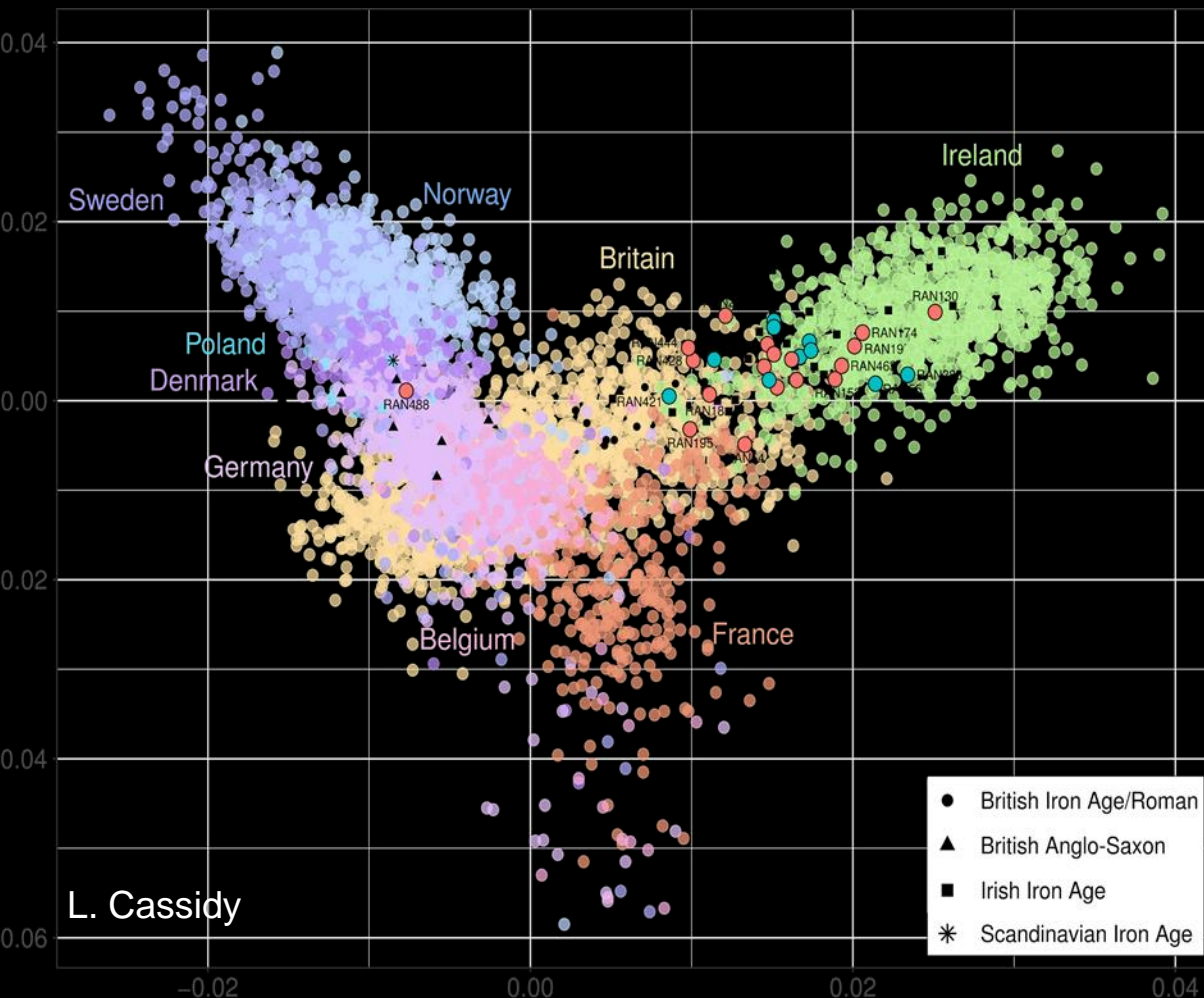
Ranelagh - aDNA

Ranelagh individuals projected onto a PCA plot of Northern European variation.

Most - averages of population clusters from Central Leinster, South Leinster and South Scotland. Continuity between Ranelagh individuals and modern Irish population.

Outliers –

- Sk 488 (OA F 10-11th c) – Mainland Europe
- Sk 54, Sk 195, Sk 428 and Sk 452 (earlier) and Sk 421, Sk 444 (later) - close to those from Scotland and Wales.
- Sk 130, 174, Sk 283 - closer to samples from Munster, Connacht and Northwest Ulster).



Disease:

- All except Sk 255 lactose tolerant
- Sk 380, Sk 358, Sk 420, and possibly Sk 19 – carriers for haemochromatosis
- No evidence of cystic fibrosis mutations

L. Cassidy

79.
Irlan^dois et Irlan^doise comme ils alloient accoustres es lans au service de feu Roy Henry



Acknowledgements

- Roscommon County Council – Gary Kelly & Martin Curley
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- National Museum of Ireland – Nessa O'Connor
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- British Academy Leprosy Project – Dr Mike Taylor, Dr Alistair Pike & Ed O'Donovan.