Heillog Bein, Brotin Bein: manifestations of disease in Medieval Iceland

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In any course on human anatomy and osteology, including palaeopathology, Wolff's Law (1892) remains a foundational concept. According to Wolff's Law, bone is constantly remodelling in response to stressors and forces upon it, whether pathological or activity-induced, so that the bone architecture, shape and robusticity is altered.[1] The interactive process to maintain healthy bone occurs between groups of osteoblast and osteoclast cells. Operating within the basic multicellular unit, osteoclasts resorb diseased or otherwise defunct bone cells, and this activity precedes the work of osteoblasts responsible for the formation of new bone cells.[2] When these cell groups replenish bone cells in a typically healthy individual, this is referred to as normal bone remodelling. The resorption phase typically lasts for three weeks, while the bone remodelling work of the osteoblasts usually takes three months.[3] When this process is inhibited or suffers from an imbalance due to some disruptive mechanism, the signs remain on the skeleton.[4] Time is therefore also an important component in this system, as the passage of time allows a disease process to enact change on a skeleton. More recent research has offered some necessary clarification to the principles of bone remodelling, especially the ways in which the response differs at various sites and with various stimuli.[5] In younger individuals, i.e., those who are still growing, growth abatement is a common outcome until the stressor is removed or overcome, and for purposes of age estimation, the developmental stages of the dentition and epiphyseal union are the most robust indicators available for ageing juveniles, as their development is less susceptible to such disruptions.[6]

Those unfamiliar with bone architecture and function in living animals and human individuals perhaps tend to think of bone as largely the hard mineralised component, and thus imagine a skeleton to be only composed of this hard remainder, the stuff of most museum and laboratory encounters. Ancient and medieval peoples, perhaps more than many modern populations, would have understood that the central component of bone, the soft inner marrow, was a nutritious foodstuff. They would have been familiar with the pliability and texture of hand-worked bone to be used as tools or decorative elements. It is this pliability of once-living and dynamic bone upon which palaeopathology has come to rely for registering changes in a skeletonized individual.

[1] Pearson and Lieberman (2004: 63); Wolff (1986: 23–24).
[2] Matsuo and Irie (2008: 202).
[3] Matsuo and Irie (2008: 206).
[4] Cf. Aufderheide and Rodriguez-Martin (1998); Ortner (2003).
[5] E.g., Pearson and Lieberman (2004: 65).
[6] Milner and Boldsen (2012: 279).

Palaeopathology relies on physical descriptors to determine a biological diagnosis. It can be said to be distinct from basic osteological analysis in that it registers more than the basic data of sex, age and measurements, but without such data complementing a pathological diagnosis or description, then certainly the pathological assessment may be of less value. For palaeopathologists, the social context of disease is secondary to the biological phenomenon. This is the legacy of its origins in the field of medicine, where objective evidence is paramount. It is also a function of an understanding that no written records may be available to help contextualise any observed phenomena, or textual witnesses may be scant or otherwise considered unreliable. However, this is not to say that the social context of disease in textual evidence is wilfully ignored; in fact, it is a desired component of any analysis in bioarchaeology that would depict not just the biological phenomena but its contemporary impact.

As a distinct discipline today, palaeopathology is relatively young, with its roots in the work of a few medical practitioners of the 20th century who investigated human remains from archaeological sites with a systematic and clinical approach. In Iceland, Jon Steffensen's work in particular signals the beginning of a crucial shift away from sole reliance on the sagas, settlement records and other texts to relay history, and in particular the history of disease in Iceland.[7] Rather than attempting to peruse the vast body of Icelandic literature available, this paper will attempt to test the congruence of some examples from the literature with pathological conditions which have been identified in some skeletal remains. The hope is to offer a lens through which medieval historians and students of the history of medicine may approach palaeopathology. It is usually ill advised to attempt to diagnose conditions from descriptive texts alone, and by the same turn, not all diseases will leave distinct marks, if any, on the bones. However, some pathological and/or endemic disease conditions have been reported in medieval and pre-modern Iceland, and have been described in the text in enough detail to allow fairly confident analysis and identification. These conditions will be the focus of this article, while the reader should bear in mind that any attempts to deal with textual authenticity or depictions of the intended audience fall outside of its scope.

The Literary and Archaeological Evidence from Medieval Iceland

According to criteria synthesized by Piers Mitchell, retrospective diagnosis from text works best within a set of optimal parameters for reliability. These include eyewitness testimony, vivid description of the signs and symptoms of disease (including one or more virtually diagnostic symptoms), description of the nature of any lesions and location, little to no evidence for a description which mimics medical views of the period, and finally plausible epidemiological

[7] Zoëga and Gestsdóttir (2011; 203); Gestsdóttir (2012: 548).

observations in the text.[8] Some of the pitfalls of retrospective diagnosis can include (but are not limited to) a lack of information in the text itself, a researcher's own limited understanding of cultural context, including, for example, the inability to detect that a record which purports to be that of an eyewitness may in fact be a later copy, and finally, an inability to maintain an open mind in thinking outside of a range of modern possible diagnoses or considering that a disease may mutate and change over centuries.[9] In some of the examples given later, it is clear that some Icelandic words for certain illnesses were commonly used in the 19th century but fell out of use by the early to mid-20th century. Some terms would certainly have conflated diseases of very different aetiology, and there is no deconstruction of the text possible to attain a retrospective diagnosis in most cases.

Reading in the rich literary tradition from Iceland encompasses the sagas and miracle stories with some reference to local historic annals. Some of the material offers a window into social constructs regarding illness as well as the physical and biological components of the disease experience. Medieval Icelanders believed there were links between emotion and anatomy, especially in a way that can precipitate anatomic changes or differences.[10] Emotional disturbances and strange behaviour, characteristics like timidity or courage, were believed to correlate with the size of one's heart (referring to someone as 'small-hearted' is still commonly used in Icelandic today, and could indicate a sensitive child, for instance). Fear can make one vulnerable to cold, especially when outdoors. In *Eiríks saga rauða*, Sigríður is assisting another woman who has fallen ill. Some have already died of this illness which has swept the farm in Greenland. She experiences coldness and a vision which portends her own death; an illustration of the 'open' body schema of medieval Icelandic beliefs about the body, in which an external element, in this case a draft of cold air, penetrates the body, both conferring illness or disease and acting as an omen of death.[11] This is one of many examples in which not enough information has been transmitted to allow the reader to assume any biological interpretation of these events.

Treatment of the Deceased

In medieval Icelandic archaeology, the shift parameters towards communal burial can be defined fairly simply. After the settlement period or *landnám* (land-taking), which began in the late 9th century, the entire nation converted to Christianity with a parliamentary motion in the year 999.[12]

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[8] Mitchell (2012: 318).
[9] For a complete rundown of potential pitfalls in retrospective diagnosis and how to determine optimal reliability from a source document, see Mitchell (2012: 318).
[10] Kanerva (2014: 228).
[11] Kanerva (2014: 232).
[12] Einarsdóttir (1964: 52).

The archaeology concurs with this dating, as the burials move from a typical pre-Christian Viking mound style in home fields to larger family and community groups being buried in local churchyards.[13] It is believed for this reason that most of the individuals interred in Christian cemeteries are quite representative of the communities once established there. The boundaries of sacred spaces seem largely to have been respected as generally exempt from violence and aggression, for both priests and church properties indicated in 13th-century Iceland.[14]

This immunity of the body did not entirely extend to the grave, as many disarticulated individual remains can attest, though some higher-status graves were excepted, as they seem relatively undisturbed at Skriðuklaustur. Over 300 individuals were recovered from the grounds of the former monastic hospital in east Iceland (1496–1552), and more may remain in the earth. Many disturbed individuals were recovered, including adults and children; preserving the integrity of the deceased's entire corpse was not of paramount importance but it appears to have been at least attempted, when convenient, in a majority of cases. From the burial context, it seems it was considered best to keep individuals in the ground when they were accidentally exposed. However, it does not appear that initial placement was especially important, though an east-west alignment was usually maintained. Thus, articulated limbs were a common find in grave fill or placed alongside other individuals. In one such case, a fully articulated adult individual in Grave 106 was excavated with the vertical upper body and torso of another individual at its foot. Whilst digging a new grave cut, the work most likely exposed the upper portion of this second individual, and so the body was simply tipped upright at the waist.[15]

For medieval Icelanders, bones could be holy relics, and even if these relics were not themselves accessible, powers of transmission were possible. There are examples of *beinavatn*, water in which a saint's relics had been washed, being applied to cure various ailments, including tumours, traumatic injury and even *vatnormur* (see section on *sullaveiki* below).[16] Sigurður Samúelsson's *Sjúkdómar og Dánarmein Íslenskra Fornmanna* (1998) is an excellent source for exploring specific examples from texts, centred around the physician's clinical perspective on descriptions of illness.

Some of the miracle stories indicate an expectation of care by the church that is not just confined to hoping for a miraculous cure. A very early example describes the treatment of 19-year-old Guðmundur Arason, who later became bishop at Hólar. He suffered a broken leg when a ship was stranded during poor weather at sea and was taken to land to be treated by a *læknir*, a term still used

[13] Vésteinsson (2000: 71).
[14] Jakobsson (2010: 12).
[15] Author's own experience.
[16] Skórzewska (2008: 107).

in Iceland meaning doctor (here perhaps best understood as a 'healer').[17] The leg did not heal well—*leggja brotin stóðu út úr*—essentially, the leg was set at a bad angle. After some time had passed and Guðmundur had travelled to another part of Iceland, another healer had two men to help him to take bone, the largest *beinflísa* (bone splinters/sequestrum), out of the fracture site, and finally the leg healed well. The period of time from the initial accident to the final healing totalled seven and a half months. About 80 years after his death in 1237, his remains were exhumed with the permission of the bishop at Hólar, and the leg was described as having *hnútarnir mjök stórir sem von var að eftir að brotnaði fótr hans*—very large knots which could be expected after a leg fracture.[18] This text offers some remarkable insights into medical knowledge in a very early period in Iceland. Medical knowledge and healing were evidently practiced in different parts of the country, and healers were trustworthy individuals who are named in the accounts. A broken bone could be set and healed, and healers could even reset badly healed bone and to some degree apply surgical intervention when necessary. Another interesting story of a bone fracture offers less detail, but some tantalising morsels in *Íslendinga saga*: Loftur breaks a foot one summer and finds it to be badly set when healed. Then he allowed it to be broken again and gave his own instructions on how it should be bound—'Lét hann þá brjóta í annat sinn, ok saga sjálfr fyrir hve kinda skyldi.'[19]

Identifying Trauma and Chronic Disease

Traumatic injury is often recognised in the more dramatic examples as above, but traumatic events may produce less pronounced changes, for which the skill of a human osteologist is necessary. Injury to and healing of bones in children and adolescents often presents differently than in the adult skeleton, and collecting population-level statistics is one of the best means to ascertain how past societies treated their youngest and most vulnerable, and what exposure to particular stressors entailed. In cases of severe illness or trauma, as in the story of Bishop Guðmundur Árason above, bone may die, producing an involcrum of new bone around the dead bone (sequestrum).[20] This is one of the more extreme examples of bone change that may be identified, but even skilled healers could deter the worst possible outcome, as in the case of an example of a femoral fracture in Figure 1; there is obvious asymmetry, but the bone appears to have healed well and without evidence of severe infection. Perhaps a contemporary would also have described these features as *hnútarnir mjök stórir*.

[17] Samúelsson (1998: 220–221) citing *Bysk. II Guðmundar saga Árason* (187, 198). There are a number of interesting elements to the biographies available about Guðmundur biskup, including what could be an early depiction of a migraine headache (Samúelsson 1998: 222).
[18] Samúelsson (1998: 221).
[19] Samúelsson (1998: 130), citing Sturlunga II.b., *Íslendinga saga*, p. 98.
[20] Ortner (2003: 182–185).

Tuberculosis, treponematoses and leprosy serve as good examples of chronic infection, which have a long duration or recur frequently, and may be identified according to the changes produced, but even these do not always leave evidence on the skeleton. Tuberculosis, for example, is reported to cause skeletal change in only 3 to 7 percent of cases.[21] Many reports on human remains will cite nonspecific infection or inflammation as a diagnosis of bony lesions, as not all pathogens or traumatic events are pathognomonic—i.e., not all leave lesions that can be linked to a specific disease. As the body's first response to pathogens is inflammation, this can appear as pitting of the bone surface (a periosteal reaction), new bone deposition or new woven bone. Thus even chronic diseases with statutorily accepted diagnostic criteria may be non-specific in early stages of infection and therefore unrecognisable.

Treponemal Disease/*Sárasótt*

Although evidence for treponemal disease in older Icelandic texts is not available, it is important to mention its appearance in the late 15th century in light of the persistent history of controversy surrounding its abrupt emergence in Europe in the Middle Ages. Until the excavation at the monastic site Skriðuklaustur produced evidence of treponemal disease in Icelandic skeletal remains, many believed the disease to have only arrived in Iceland in the 19th century. *Bartskerar*, barber-surgeons, were invited by the bishop Ögmundur Pálsson in 1525 to come to Iceland, and a good tract of farmland was offered as payment for healing the populace from syphilis.[22] However, a belief has persisted among historians that the medieval authors of documents referring to syphilis were confusing the disease with leprosy or scrofula.[23] While there is some possible support for this theory in relation to medieval belief in a venereal transmission of leprosy, this theory has been refuted using evidence from skeletal remains indicating that these conditions could not have been confused.[24]

When identified in human skeletal remains, the changes produced by tertiary syphilis distinctively affect the long bones and the cranium, with the most commonly affected being the tibia and the frontal and parietal bones of the cranium. Other affected bones may include the nasal-palatine region, sternum, clavicle, vertebrae, femur, fibula, humerus, ulna and radius. The gummatous lesions of the skull, also known as *caries sicca*, are very distinctive. These lesions may resemble other conditions such as tumours and tuberculous infection, but differential diagnosis can often solve confusions that may arise. In addition to the changes described above, in cases of congenital

[21] Aufderheide and Rodriguez-Martin (1998: 133); Holloway et al. (2011: 403).
[22] Þórláksson (2003: 124); Ísleifsdóttir (1997: 104).
[23] Ísberg (2005: 162); Þórláksson (2003: 124).
[24] Roberts and Manchester (2007: 213); Crane-Kramer (2002: 117).

syphilis, further distinctive changes to the dentition would be recorded.[25] It is worth noting that syphilitic lesions on a human skeleton represent an advanced stage of chronic disease. The condition is known to affect brain function when left untreated and therefore could also impair mental capacity. These circumstances are of course impossible to delineate from human remains alone but bear consideration in the spectrum of disabling and disfiguring disease in social context.

Hydatid Disease/*Sullaveiki*

A study of disease in the past must also carefully consider the human-animal relationship in the past. The greatest consequence of domestication of dogs and sheep and their import to Iceland soon after settlement was the accessory import of a deadly tapeworm. The term *sullur*/*sullr* refers to a cyst, though its precise aetiology is unclear, and at least from the 19th century onwards the term *sullaveiki* is associated with liquid-filled cysts, sometimes with a fully or partially calcified perimeter. Even in the 19th century, however, many doctors believed these idiosyncratic swellings to be the result of a form of hepatitis unique to colder northern climates, and it was only the work of the Danish doctor Harald Krabbe which undid this misconception; the association with hepatitis was probably due to the parasite's proclivity to cause swelling of the liver.[26] It is certain that a parasitic helminth, *E. granulosus*, became endemic after *landnám* and remained so until the mid-20th century when it was eradicated from Iceland.[27] Described as one of the 'worst and most dangerous diseases in Iceland', hydatid disease, or echinococcosis, appeared with enough frequency in the population to be listed alongside tuberculosis and leprosy as one of the most distressing endemic diseases in Iceland, even at the beginning of the 20th century. Many doctors in the 19th century reported finding cysts during autopsies.[28] Characterised by localised swellings, the condition may impair particular organs and skeletal tissue, and eventuate in death, but may also progress for some years before the victim suffers great discomfort.[29]

The parasite's hosts during its life cycle are dogs and sheep, and humans may be accidentally infected in any area of the body. Transmission is most often a result of fecal-oral contact via the infected waste material of dogs or sheep. The consequences of infection by the worm and its larvae mean that though the liver can normally filter out such infections after accidental ingestion, it may be overwhelmed and is the primary site of infection in 60 percent of cases, followed by the lungs (30 percent) and other organs/sites in the body.[30] For our purposes, cyst fragments are represented

[25] Aufderheide and Rodriguez-Martin (1998: 158, 161, 163–164).
[26] Krabbe (1864).
[27] Dungal (1946: 12); Richter and Elmarsdóttir (1997: 151).
[28] Jónsson (1900: 89), my translation; Halldórsdóttir (1995: 28, 30).
[29] Arinbjarnar (1989: 402).
[30] Thaler et al. (2010: 1417–1418).

in the archaeological record and can be identified through a process of differential diagnosis. A hydatid cyst of approximately 17–20 cm in diameter, ovoid in shape, was recovered from an elderly female skeleton at Skriðuklaustur, and another example which was perhaps as large as 15 cm in diameter was recovered from an elderly female at Viðey, an island in the greater Reykjavík area.[31] There are a number of miracle stories which very likely refer to infection by this parasite, specifically stories which mention water draining from a puncture site. However, not all references to *sullr* can be definitively tied to this condition, though many are probably linked. A term which appears in the literature, *vatnormur,* meaning literally 'water-worm', can be linked to this condition with some confidence.[32] One may postulate further that *vatnormur* evolved to *sullr* with the caveat that *sullr* entertains a number of diseases which produce swelling. Specific examples are found in Sigurður Samúelsson's book and include the story of Halla Lýtingsdóttir in *Vopnfirðinga saga* (13th century), and the story of a young girl, Árnríðr, in *Jóns saga Hólabyskups ens Helga* XLI, as well as at least three others from *biskupa sögur* (mid-14th century) (though these are somewhat less detailed). Árníðr's story offers an especially useful insight; her father comments that he has recognized such swellings in his animals, and if it were one of his animals, he would puncture the site himself.

Leprosy/*Holdsveiki*: A Conspicuous Absence

Some of the better-known historic examples of leprosy come from the annals concerning the Icelandic bishops and their households, and others such as some of the district sheriffs, beginning in the early 17th century.[33] Known first in *Fornaladarsögum Norðurlanda* as *líkþrá* (*lepra*) and later more commonly as *holdsveiki,* at least four hospitals were established to treat leprosy, all of which were disbanded by 1848 (Skriðuklaustur is not included in this list).[34] Usually, leprosy would be diagnosed in a skeleton by a triad of signs designated as *facies leprosa,* including atrophy of the anterior nasal spine, atrophy and recession of the alveolar processes of the maxillae (the upper jaw), and inflammatory changes which cause the appearance of receding bone around the maxilla and nasal aperture in conjunction with changes to the hands and feet.[35] However, the skeletal record has yet to yield convincing evidence of this disease in the growing numbers (currently *c.* 1,300) skeletons currently curated in Iceland.[36]

[31] See Kristjánsdóttir and Collins (2010); Collins (2013); Gestsdóttir (2004: 28).
[32] *Biskupa sögur* III: 445–446; Samúelsson (1998: 34); Skórzewska (2008: 107). Skórzewska is less certain of the origin of the term *vatnormur,* but Samúelsson assesses it confidently as linked to hydatid disease.
[33] Jónssson (1944: 122ff.).
[34] Samúelsson (1998: 28–29).
[35] Boocock et al. (1995: 265); Ortner (2003: 264; 2008: 202–203). *Facies leprosa* was first described by Möller-Christensen et al. (1952: 336).
[36] Gestsdóttir (2014: 131).

The conspicuous absence of leprosy in the skeletal remains from Iceland can be attributed perhaps to the presence of endemic tuberculosis. Although the evidence from later 20th-century medical reports falls outside of the usual scope of a medieval study, some important points regarding the epidemiology and morbidity of disease in a population can cast light on how disease may have exhibited in the past. The medical establishment in the 19th and early 20th centuries recognised that tuberculosis could be reactivated in a person following a latent period, and was believed with treatment (as it was provided in the pre-antibiotic era) to improve of its own accord. Evidence from annual reports in the early 20th century show that after outbreaks of other diseases such as measles, influenza and pertussis, inactive cases of tuberculosis reemerged in the medical reports, and there was a corresponding rise in the number of those being treated for consumption.[37] Palaeopathology has confirmed that skeletal lesions formed during active periods of tuberculosis may heal, sometimes leaving little trace.[38]

Autopsies of 111 cadavers that had been diagnosed with leprosy as a cause of death during the period 1898–1919 found that 46 (41.4 percent) had signs of active or latent tuberculosis.[39] In 1920, the General Surgeon (*Landslæknir*) surveyed 811 patients being treated at the tuberculosis sanatorium in Vífilsstaðir (founded 1910). Of those surveyed, 326 could relate a plausible history of when they first became infected, and 242 of those believed themselves to have contracted tuberculosis in childhood, before the age of 10. In a later report derived from patient interviews (1923), he wrote that he also believed a majority of those infected to have contracted tuberculosis which was transmitted over many generations in their households.[40]

There is also a potential for misdiagnosis of cutaneous facial lesions, particularly in the early stages of leprosy. Differential diagnosis of ulcers or chancre can include syphilitic chancre and *lupus vulgaris* (produced by tuberculosis). In fact, the minutes of the medical council meetings and annual reports from the early 20th century do suggest that such confusion might have been more common than not, as one doctor even commented that *lupus vulgaris* seems a common tuberculosis manifestation in Denmark but is in his opinion unlikely to be a cause of the disease among Icelanders.[41] Cross-immunity to *M. leprae* in those infected primarily by *M. bovis* or *M. tuberculosis* has been proffered as an answer to the apparent decline of leprosy in Scandinavia, but

[37] Sigurdsson (1950: 12).
[38] Ortner (2003: 230); Holloway et al. (2011).
[39] Bjarnhéðinsson (1919: 148).
[40] As reported in Sigurdsson (1950: 8).
[41] Clæssen (1928: 103).

those primarily infected with *M. leprae* are rather more vulnerable to *M. tuberculosis,* and it is highly likely that these individuals succumbed sooner.[42]

A former head of antiquities in Iceland, *Þjóðminjavörður* Þór Magnússon, in a 1994 newspaper article, described being contacted in 1968 to retrieve remains from an old disused church cemetery at Gufunes, Reykjavík. Sadly, this location was associated with a former leper hospital, and the remains had been scattered across the site during construction work. The photos taken by staff from the National Museum during their rescue effort show that by the time they arrived at the site, all that remained was a large trench of approximately two to three meters' depth and width. These remains numbered approximately 768 individuals and were reinterred without examination at the new church in Gufunes. Only one individual, whose engraved silver coffin nameplate indicated that he had held a number of prominent government positions during his lifetime, including lastly Keeper of the Leper Hospital, remained intact and was then taken to be curated at the National Museum.[43] Interestingly, the skeleton of Páll Jónsson (1737–1819) is only one of a handful of individuals of known age and date in the collection (the others are some bishops and their family members from Reykholt).

Tuberculosis/*Berklaveiki*

Berklur usually refers to tuberculosis, yet its usage and aetiology prior to the 19th century is more ambiguous in many cases. In its most extreme and most commonly recognised form, tuberculosis predilects the spinal region and causes destruction of the vertebrae, sometimes leading to gibbous deformity, or kyphosis (Figure 2). It is critical to recognise that not all instances of changes to ribs indicate tuberculosis, but when observed can at most be ascribed to a chronic lung infection. In order for tuberculosis to be considered in diagnosis, a certain constellation of changes is necessary (precluding molecular analysis). A classic and most commonly recognised change is kyphosis of the spine, called Pott's disease.[44] Jón Steffensen in the 1939 excavation at Skeljastaðir in Þjórsárdal, southern Iceland, first found tuberculosis of the spine in an Icelandic archaeological context. Since then, the remains from Skeljastaðir have been examined by Hildur Gestsdóttir (2009), who proposed that tuberculosis was endemic in the valley at the time. Changes to individual skeletons indicative of lung infection have been identified at Skeljastaðir, Skriðuklaustur and Hofstaðir.[45]

[42] Lynnerup and Boldsen (2012: 467).
[43] Magnússson (1994: 19); Guðmundsdóttir (2004: 14).
[44] Ortner (2003: 230).
[45] Cf. Collins (2010, 2011, forthcoming); Gestsdóttir (2009); Sundman (2011).

Literary references to this condition are not so easily disentangled from other conditions, especially pulmonary infections such as pneumonia.[46] The sagas and the remaining parish annals contain references to conditions that insinuate similar symptoms. In cases of possible pneumonia, time to rest seems the greatest factor in recovery, along with a dose of divine intervention in *Jóns saga helga*.[47] Most of the written evidence for tuberculosis in Iceland has been cited from the 17th century and later, the most famous examples being the children and grandchildren of the bishop Brynjólfur Sveinnsson (1639–1674) at Skálholt, and of Árni Þórarinsson (1741–1787), bishop at Hólar, who died at 46 years of age of tuberculosis.[48]

Even a recent genetic study of tuberculosis risk among Icelanders has cited the general view that tuberculosis was rare in Iceland until the 19th century.[49] This follows the clinicians' view which has predominated the study of historical tuberculosis in Iceland.[50] In his landmark work on depictions of disease in Iceland, Sigurður Samúelsson concurs generally with the view that tuberculosis was not highly prevalent in medieval and pre-modern Iceland. Even though he does give a nod to Steffensen's work, he separates examples of possible tuberculosis from other diseases affecting the lungs. The descriptions of these chronic respiratory diseases, however, could be attributed to tuberculosis and should be considered as a possible aetiology, especially given its highly transmissible nature.[51] The mounting evidence in archaeological remains, from diverse regions of Iceland, also offers rather illustrative proof of its presence in Iceland much earlier than previously thought. Lastly, since Steffensen first identified an extreme case of kyphosis in the remains from Skeljastaðir, advances in palaeopathology have made it possible to identify further pathognomonic lesions which support the case for recognising tuberculosis as an endemic or epidemic disease.

Summary

Finally, a word of caution that the identification of specific infectious disease does not only incorporate a superficially limited suite of diagnostic options. Studying skeletal populations has enriched our understanding of many periods and places in history. A real grasp of health and disease in past lives requires an investment of time and resources to understand the clinical basis of palaeopathology and how the discipline approaches a host of markers of stress, metabolic deficiency and trauma, which even when cited as 'nonspecific' can offer valuable insights. Though

[46] Samúelsson (1998: 65–66) posits *lungnabólga með brjósthimnubólgu*, swelling of the lungs and chest, as a likely description of pneumonia.
[47] Samúelsson (1998: 68), citing Bysk., II. b., *Jóns saga helga*, 122 and Bysk., I.b., *Jarteinabók Þorláks byskup önnur*, 198.
[48] Samúelsson (1998: 35).
[49] Sveinbjörnsson et al. (2016: 483).
[50] Samúelsson (1998: 35); Jónsson (1944: 112).
[51] Samúelsson (1998: 65–66). In some cases *sullaveiki* may have also been the culprit for the sensation of swelling or stinging in the lungs and chest.

at times it seems an imprecise science, palaeopathology can and should shift the lens through which we approach disease and its representations in text. Textual witnesses are now more than ever supplemented by biological and archaeologically contextualized evidence of disease and social practice. Where students of palaeopathology are sometimes limited to reviewing text from relatively recent periods and often without access to the original language, collaborative work with historians can certainly remedy these gaps.[52]

Ongoing palaeopathological analysis of the human remains curated in Iceland thus far finds evidence that the presence of endemic diseases in the population, perhaps introduced even at the settlement of Iceland, may eclipse the presence of other types of infectious disease. Using molecular analysis, the material may present a fascinating opportunity to better understand the interactions between leprosy and tuberculosis. In the rest of medieval Europe, there was a distinct change from a high leprosy to a high tuberculosis ratio, and there is much direct skeletal evidence for this shift. It would appear that tuberculous infection can confer a degree of immunity to leprous infection.[53] Of course, further recovery of remains in archaeological excavation always holds the possibility to uncover evidence of leprosy or other conditions. In fact, one of the greatest mysteries of Icelandic history, the origins and form of plague, may be coloured much more by the persistent and deadly presence of tuberculosis than any other factor, and may rewrite our current understanding of plague transmission and virulence.[54] In the maelstrom of debate regarding the evidence and evidence lacking in the history of disease in Iceland, palaeopathology stands as another witness as current knowledge is expanded and consolidated.

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[52] Mitchell (2012: 310).
[53] Lynnerup and Boldsen (2012: 466–467).
[54] Cf. Callow and Evans (2016).

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