

CPG

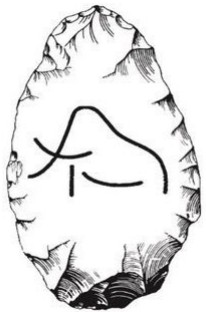


Centre for  
Palaeogenetics



# Infectious diseases in the Viking Age town of Sigtuna

Zoé Pochon



PhD student at the Centre for Palaeogenetics

Department of Archaeology and Classical Studies, Stockholm University



# Palaeopathology

## How to detect infectious diseases?

**Observation** and measurements of the remains:

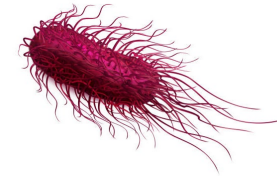
- Life-long bacterial diseases can affect bones over time like tuberculosis, leprosy, syphilis and brucellosis

**Molecular analysis:**

- Detection of **pathogen genetic material**



DNA



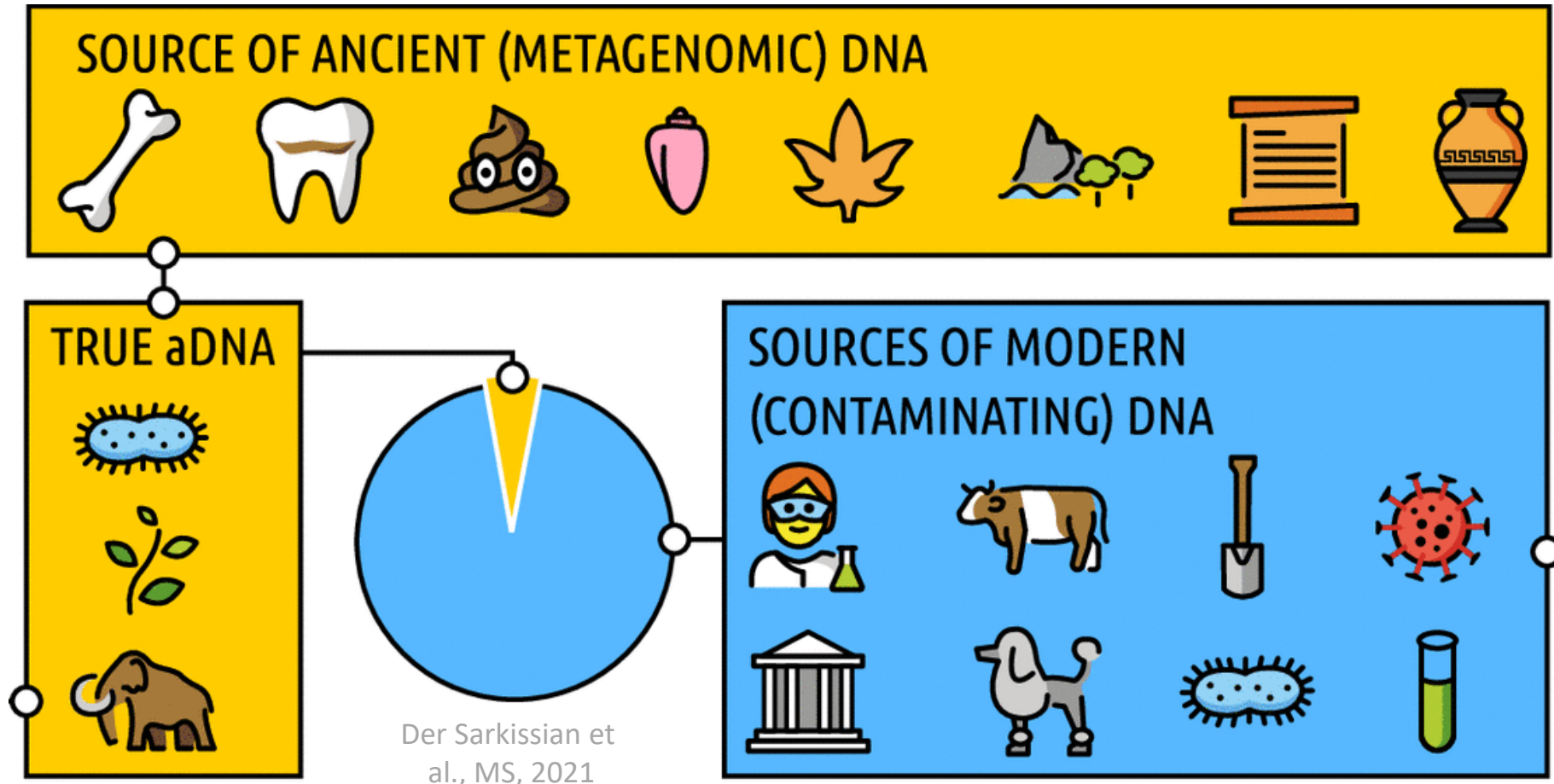
DNA



DNA (or RNA)

- And because ancient RNA is more damaged than ancient DNA, research to date has focused on infectious DNA diseases

# Ancient metagenomics: Study of genetic material from ancient remains or environmental samples

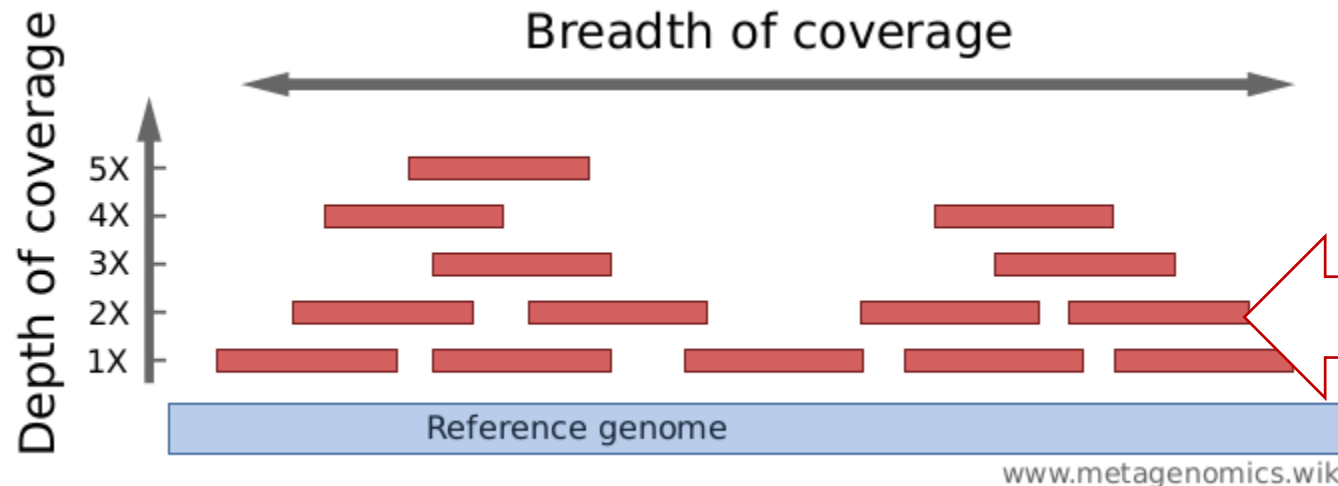


# Sequencing DNA: reads, depth and breadth



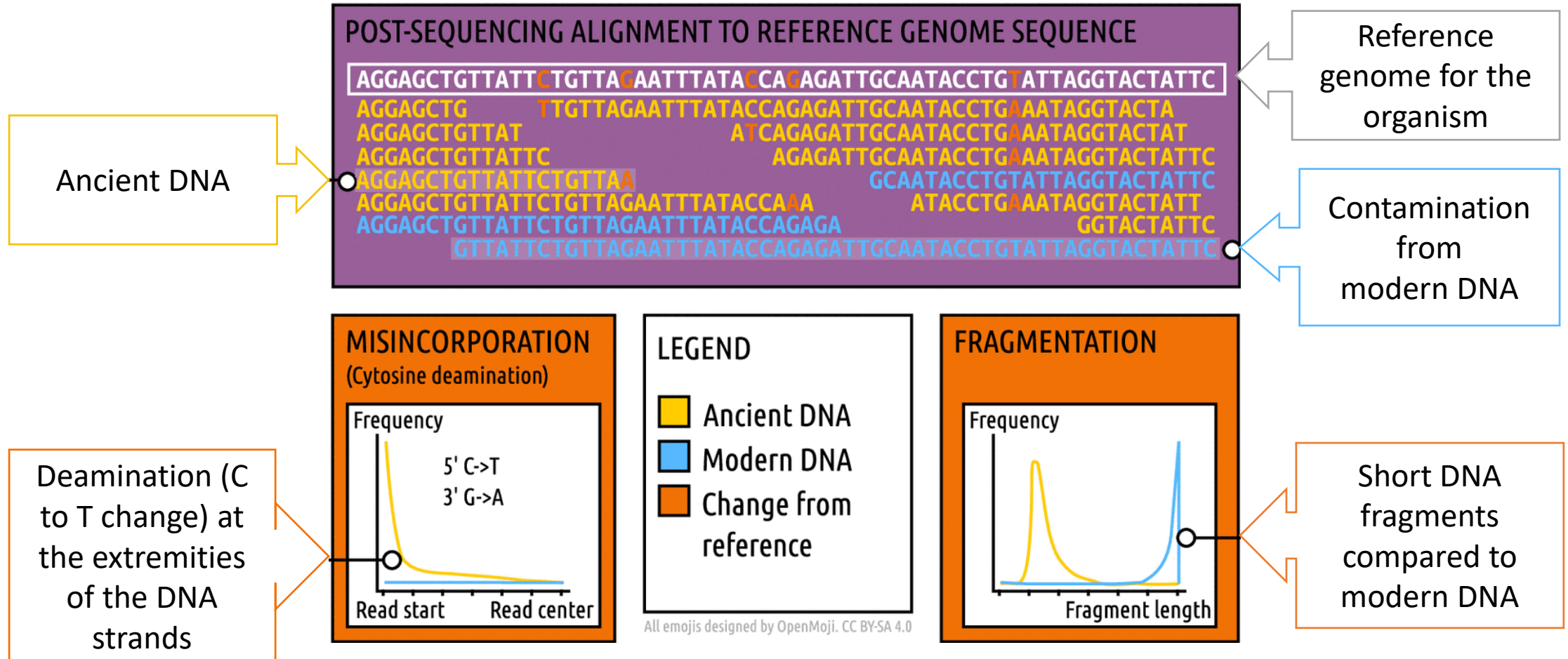
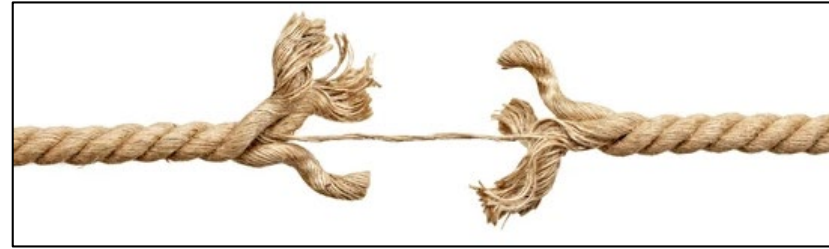
How a read looks like in real:

```
>L04459
GCAGCGCACGACAGCTGTGCTATCCGGCGAGCCCGTGGCAGAGGACCTCGCTTGCAGAAAGCATCGAGTACC
GCTACAGAGCCAACCCGGTGGACAACTCGAAGTCATTGTGGACCGAATGAGGCTCAATAACGAGATTAGCG
ACCTCGAAGGCCTGCGCAAATATTTCCACTCCTTCCGGGTGCTCCTGAGTTGAACCCGCTTAGAGACTCCG
AAATCAACGACGACTTCCACCAAGTGGGCCCAGTGTGACCGCCACACTGGACCCCATACCACTTCTTTTTGTT
ATTCTTAAATATGTTGTAACGCTATGTAATTCACCCCTTCATTACTAATAATTAGCCATTCACGTGATCTCA
GCCAGTTGTGGCGCCACACTTTTTTTTTCCATAAAAATCCTCGAGGAAAAGAAAAAGAAAAAATATTTTCAGTT
ATTTAAAGCATAAGATGCCAGGTAGATGGAACCTGTGCGGTGCCAGATTGAATTTTGAAAGTACAATTGAGG
CCTATACACATAGACATTTGCACCTTATACATATAC
```



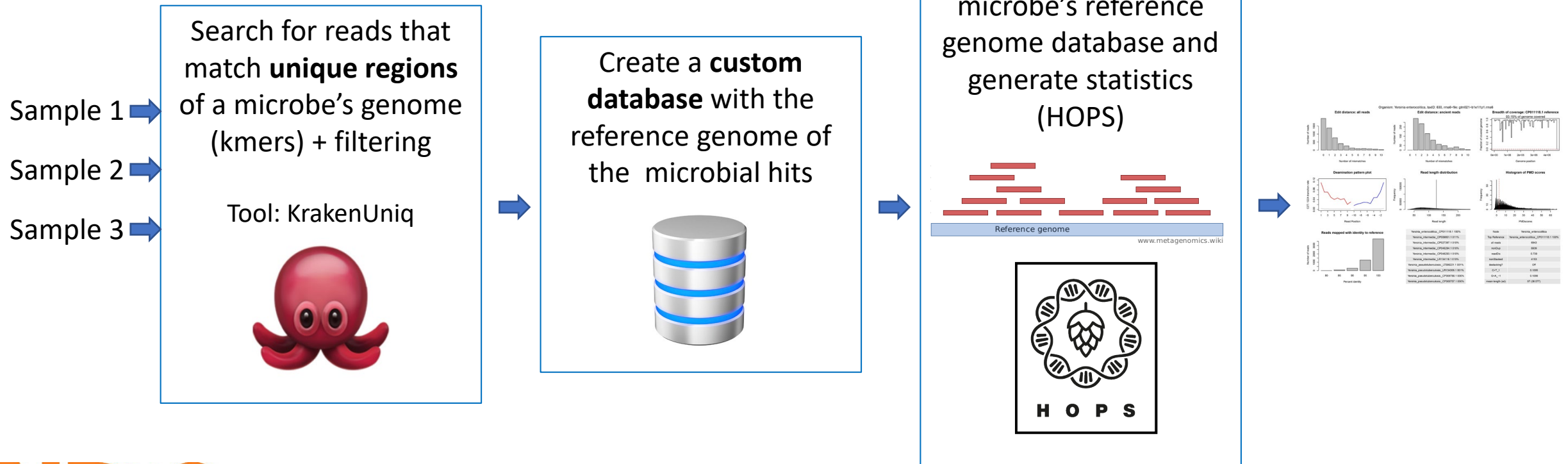
**Read or sequencing read:**  
sequence of nucleotides  
(ACGT) generated by the  
sequencer and corresponding  
to a single DNA fragment.

# Example of data

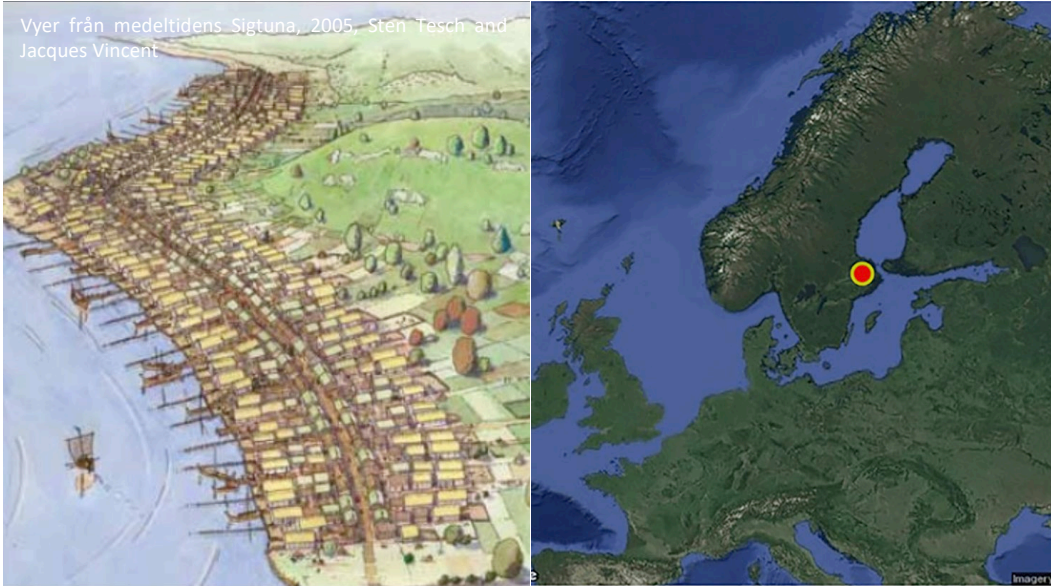




# Ancient Metagenomics pipeline (aMeta)



Vyer från medeltidens Sigtuna, 2005, Sten Tesch and Jacques Vincent

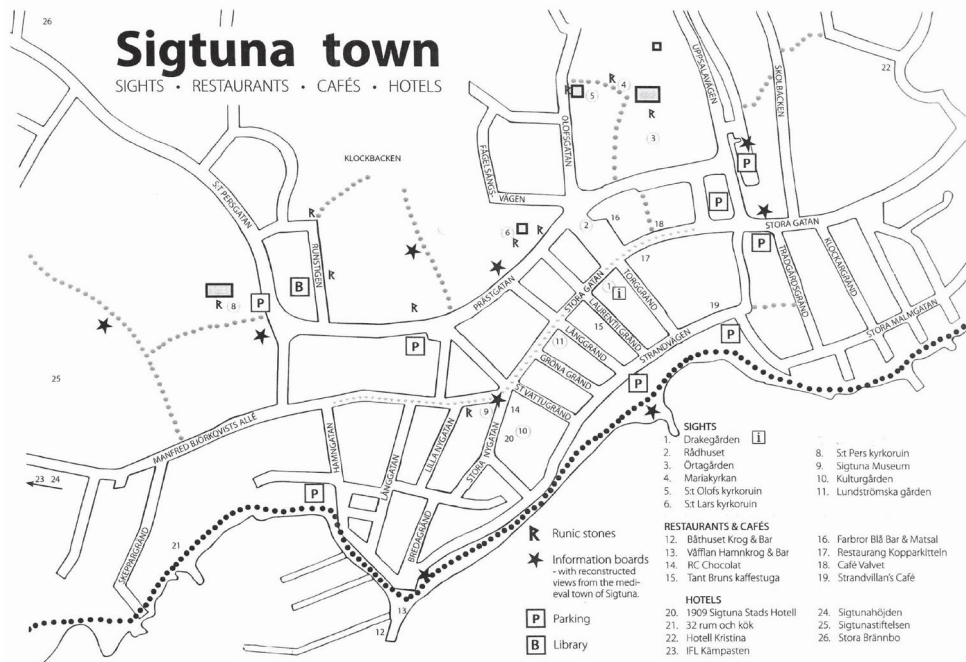


# A case study: Sigtuna

Continuously inhabited from the Viking Age on

The main street still follows the same route

Sweden, close to Stockholm airport





# Sigtuna

## Context:

- Viking Age / Early Medieval
- Early Christian town
  - No grave goods to assess status

## Beginning of urbanisation in northern Europe:

- 2<sup>nd</sup> urban environment in the Lake Mälaren Valley

Vyer från medeltidens Sigtuna, 2005, Sten Tesch and Jacques Vincent





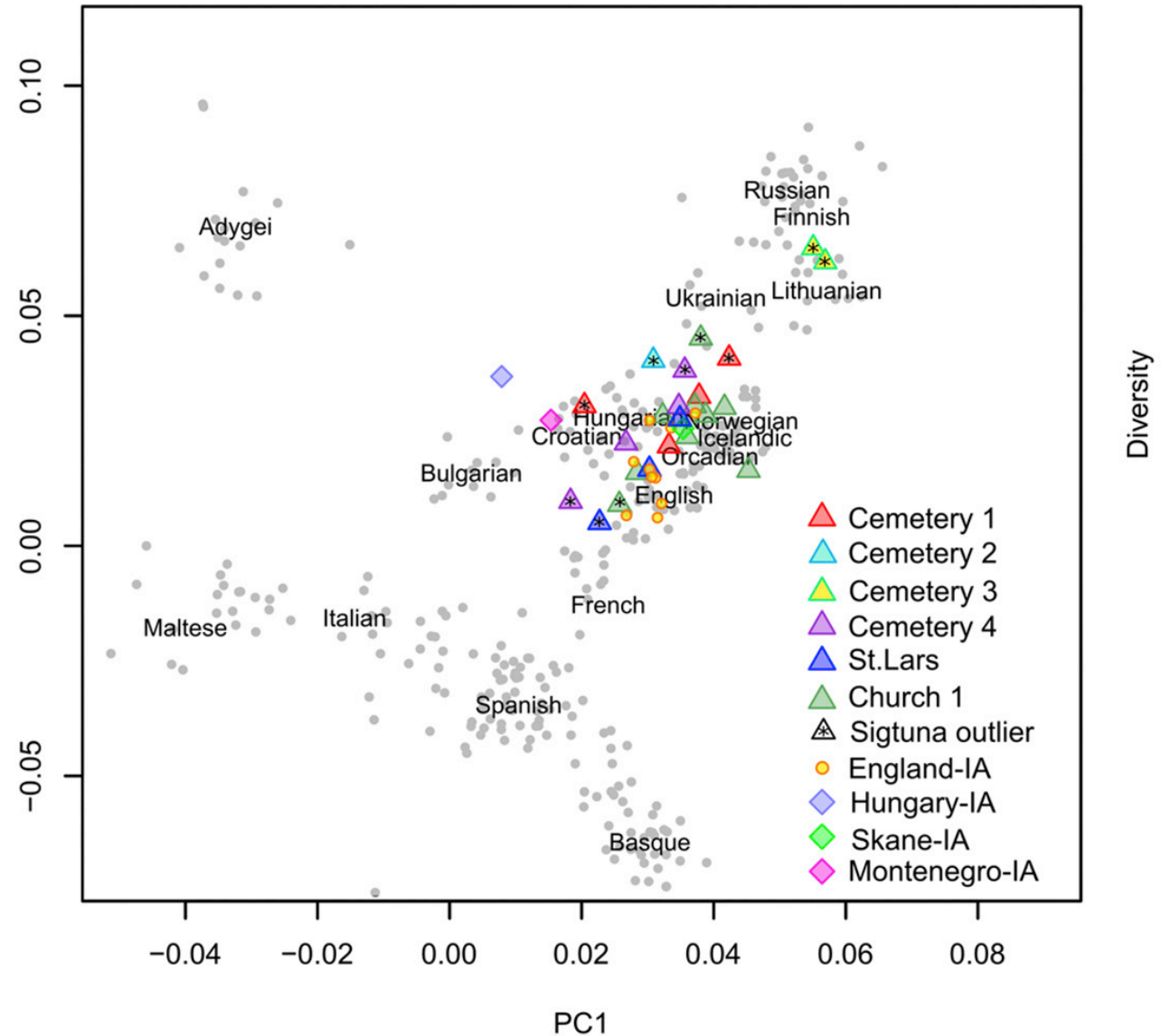
# Cosmopolitan

Local

Regional (genetics local, strontium isotope non-local)

Long-distance migrants (from all over central and northern Europe)

Krzewińska *et al.* *Current Biology* (2018)



# Environment

- Food transport and processing
- Quarantine
- Hygienic measures

were likely suboptimal at the dawn of urbanization.

“The street has recently been repaved and is therefore unusually clean. Usually it is covered with rubbish, which the city’s many pigs rummage through.” (Translated to English)

Vyer från medeltidens Sigtuna (2005) Sten Tesch and Jacques Vincent

# Our study



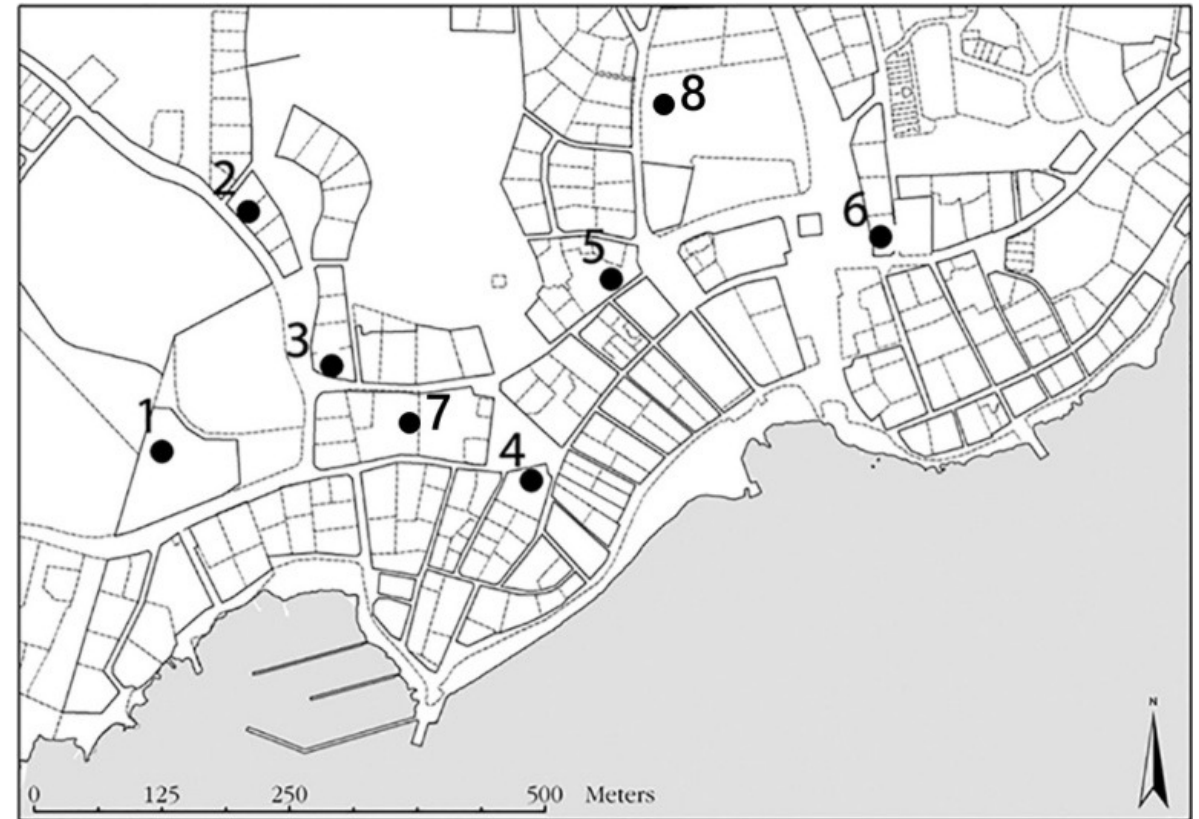
Saint Olof's Church

- **43 individuals**
- **Shotgun sequencing**
- **Threshold:** At least 0.5X depth of human coverage (as a proxy for aDNA quality)
- **Aim:** have an overview of common past DNA infectious diseases in an early urban environment



# Sigtuna's sites

1. Nunnan  
10 ind. nuf or 84-, nuf025 in prep.
2. Kålsängen  
1 ind. kls001
3. Kållandet  
1 ind. kal006
4. St. Gertrud/Urmakaren  
10 ind. stg-grt-urm
5. St. Lars  
3 ind. mbs112-151 in prep.
6. Bensinstation/Götes Mack  
7 ind. bns-gtm
7. Humlegården  
10 ind. mbs022-092 in prep.
8. St. Olof  
1 ind. mbs162 in prep.



Krzewińska *et al.* *Current Biology* (2018)  
completed with archaeological reports.