Population Structure with Genomic Data

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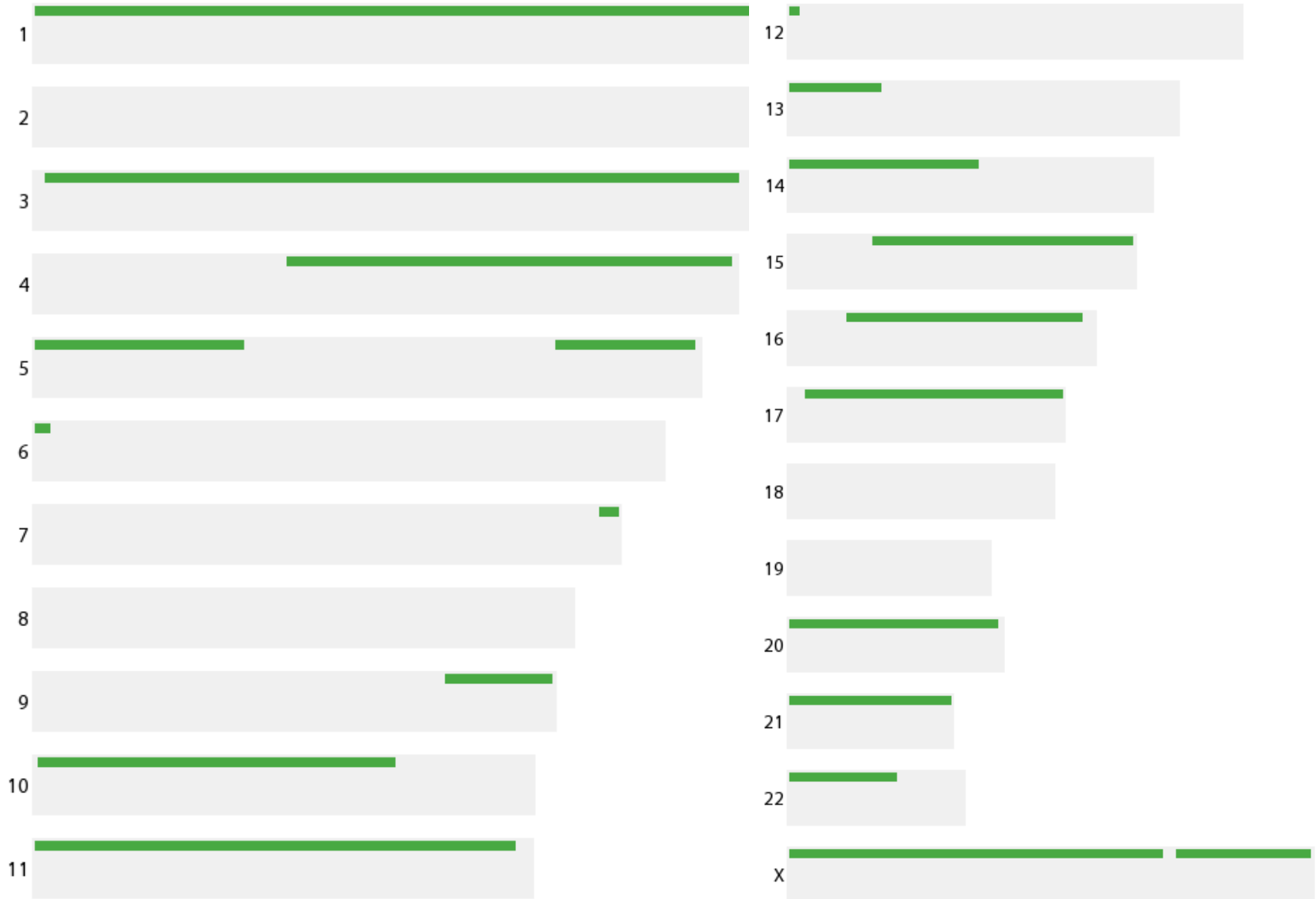
March 30, 2020

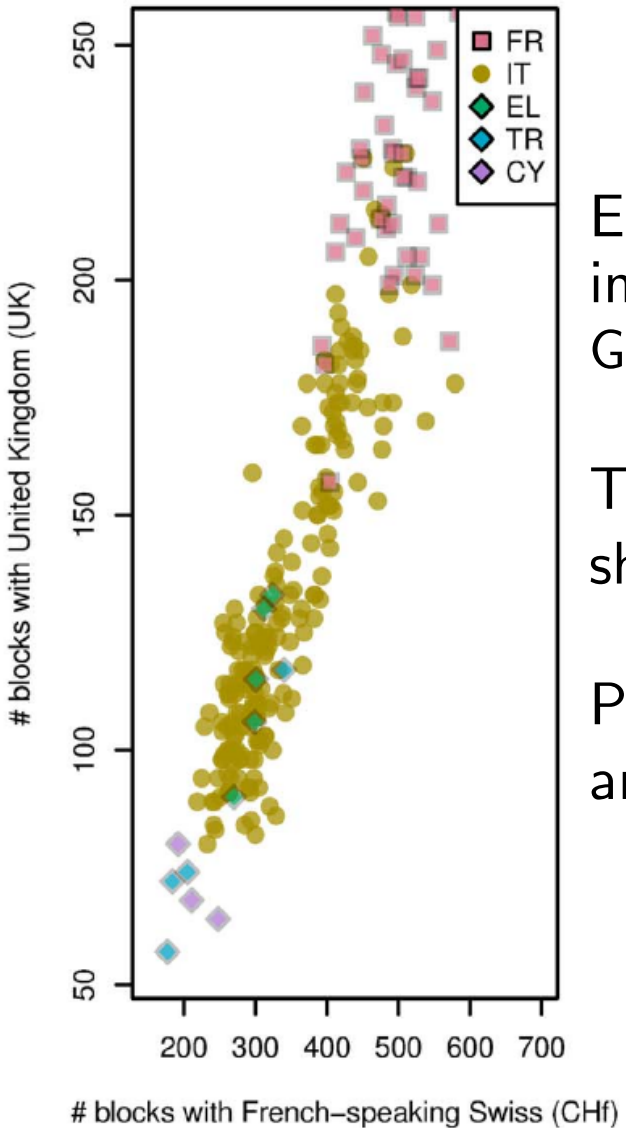
Shared blocks of identity by descent (IBD)

- With molecular data, we can identify shared IBD blocks.
- Close relatives tend to share long blocks.
- Distant relatives share short blocks.

IBD sharing between my mother and daughter



IBD sharing with French-speaking Swiss and UK



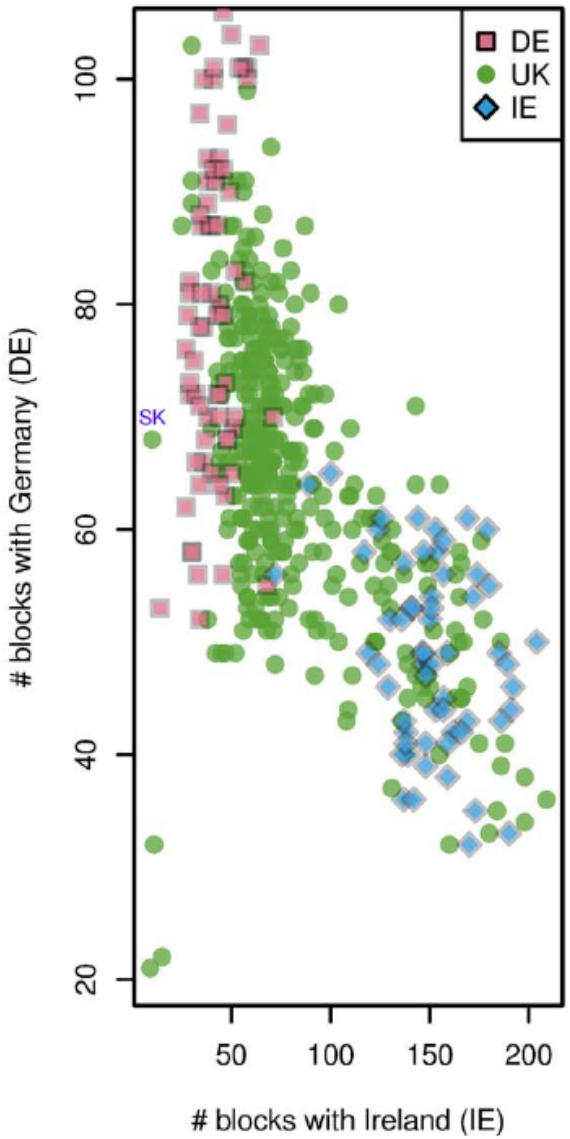
Each dot an individual. Color shows individual's origin. (FR, France; IT, Italy; EL, Greece; TR, Turkey, CY, Cyprus)

Those who share ancestry with Swiss also share ancestry with UK.

Presumably reflects immigration from ancestors of Swiss and British.

Ralph and Coop (2013)

Sharing with Irish and Germans



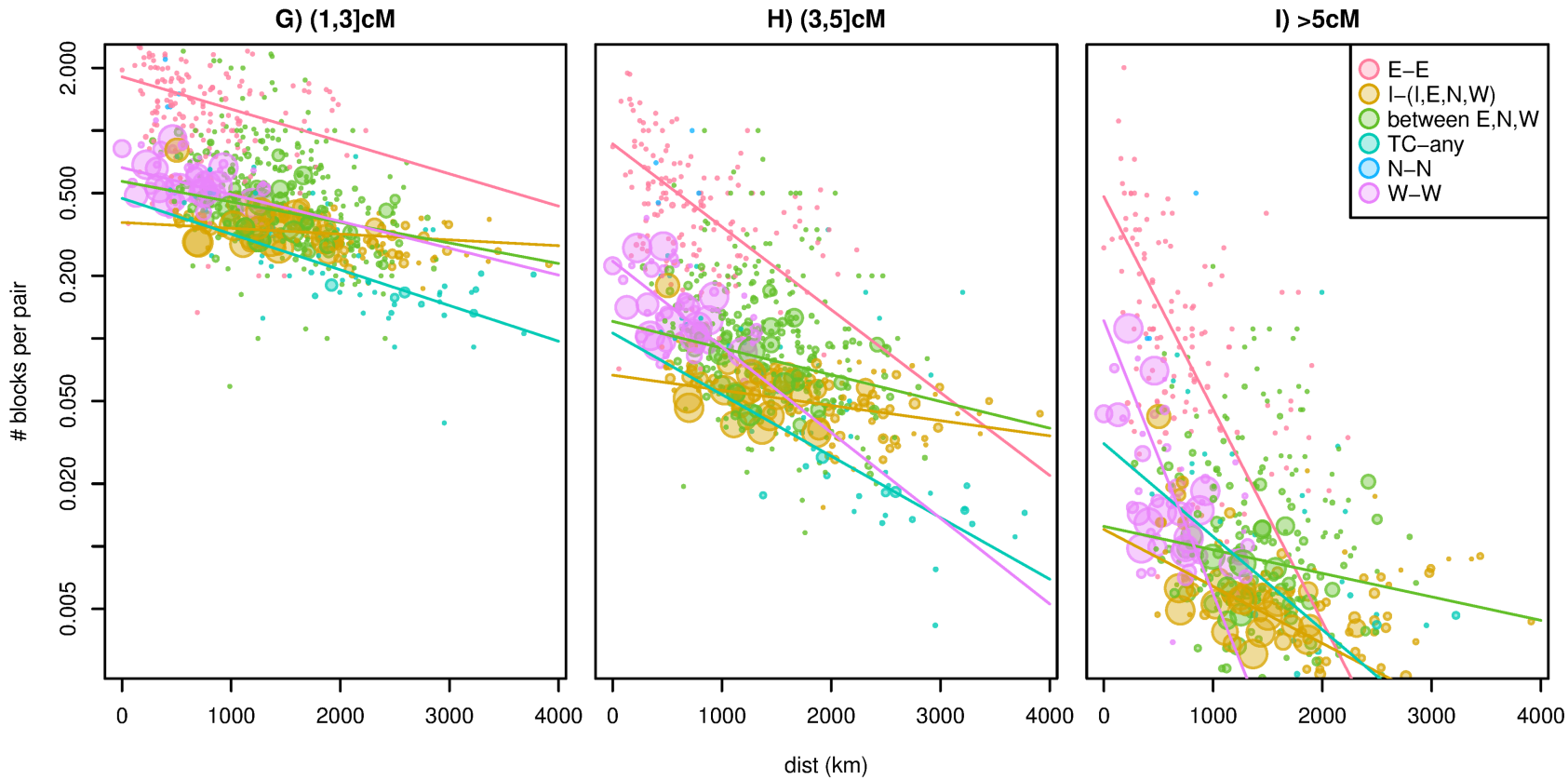
Each dot an individual. Pink, Germans; Green, British; Blue, Irish.

Brits with lots of German ancestry have little Irish ancestry.

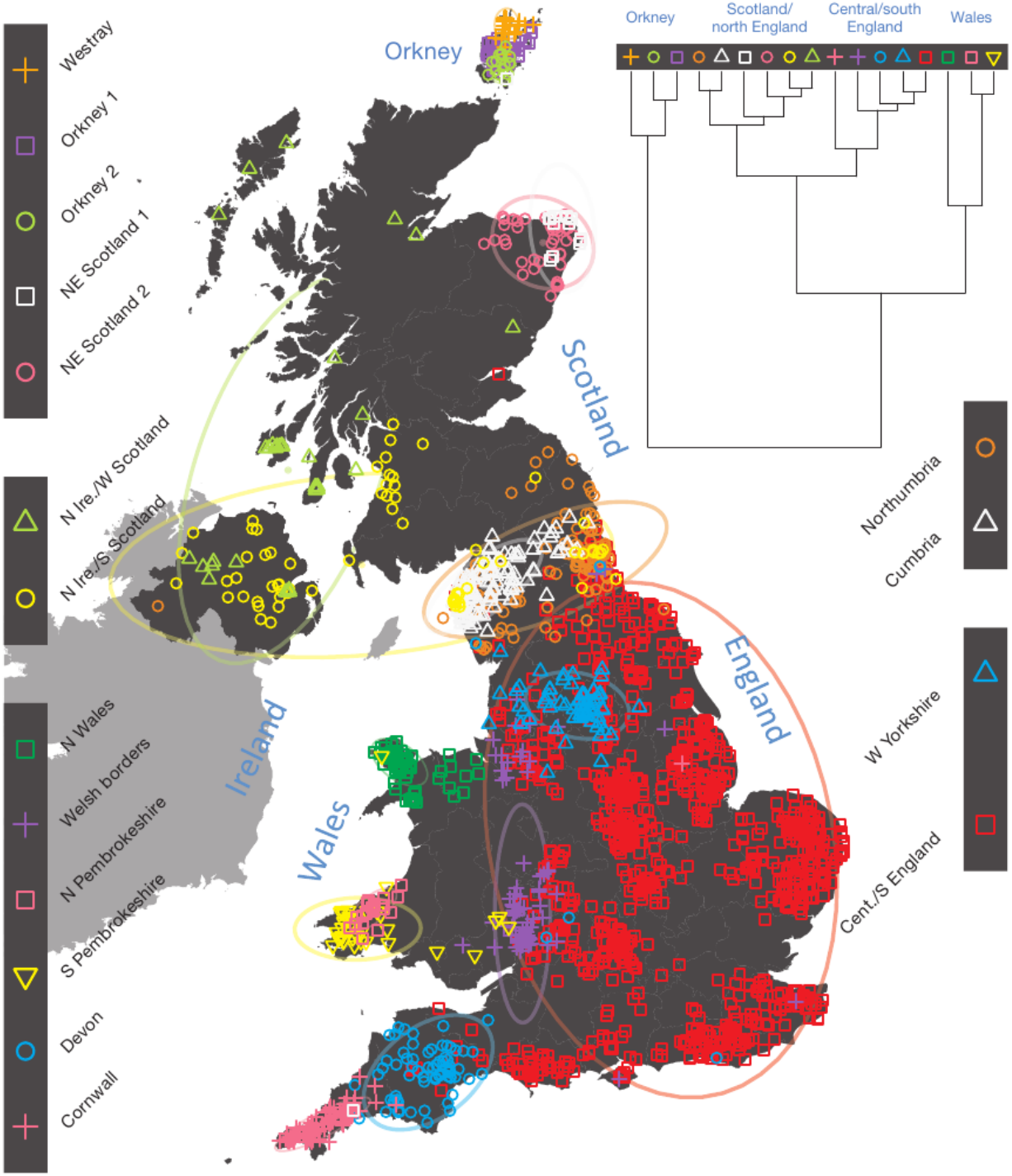
British population is a mixture of Celts and Germans.

If we focused on shorter IBD blocks, we'd be studying a different time scale, and the pattern might be different.

Geographic decay of recent relatedness

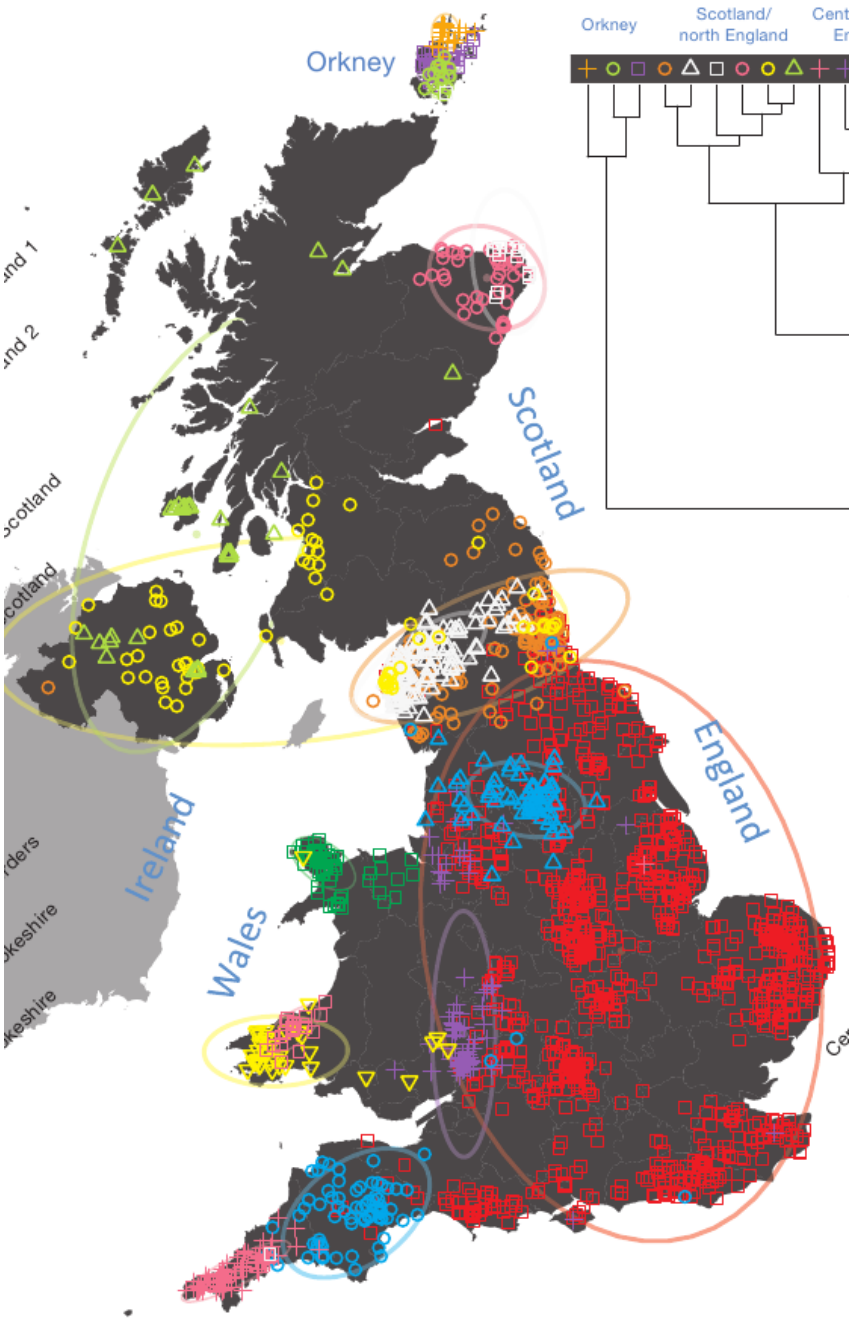


Genetic similarity versus geographic distance. Small dots are pairs of individuals. E, Eastern Europe; W, Western Europe; N, Northern Europe; I, Italy & Iberia; TC, Turkey & Cyprus. (Ralph & Coop 2013)

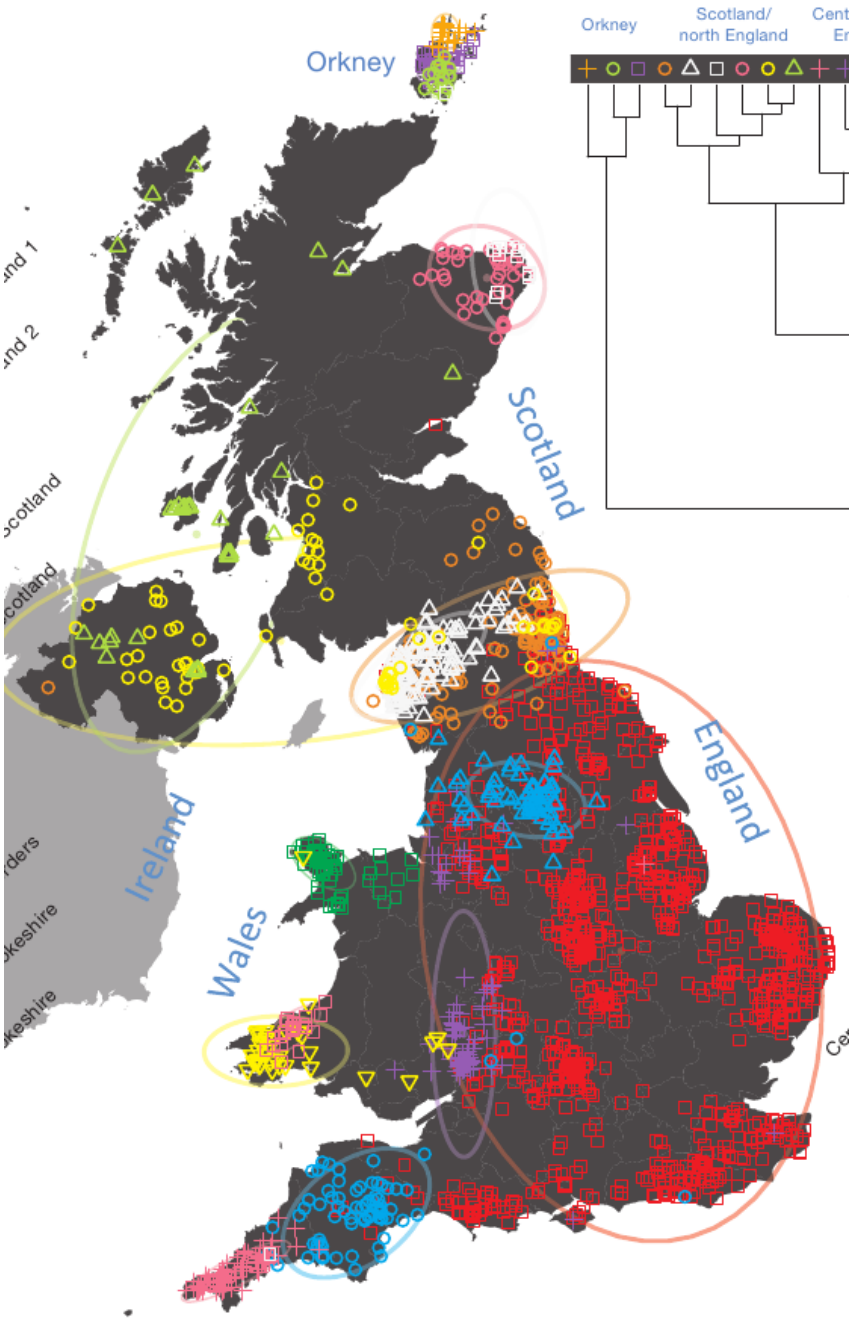


Genetic map of Britain

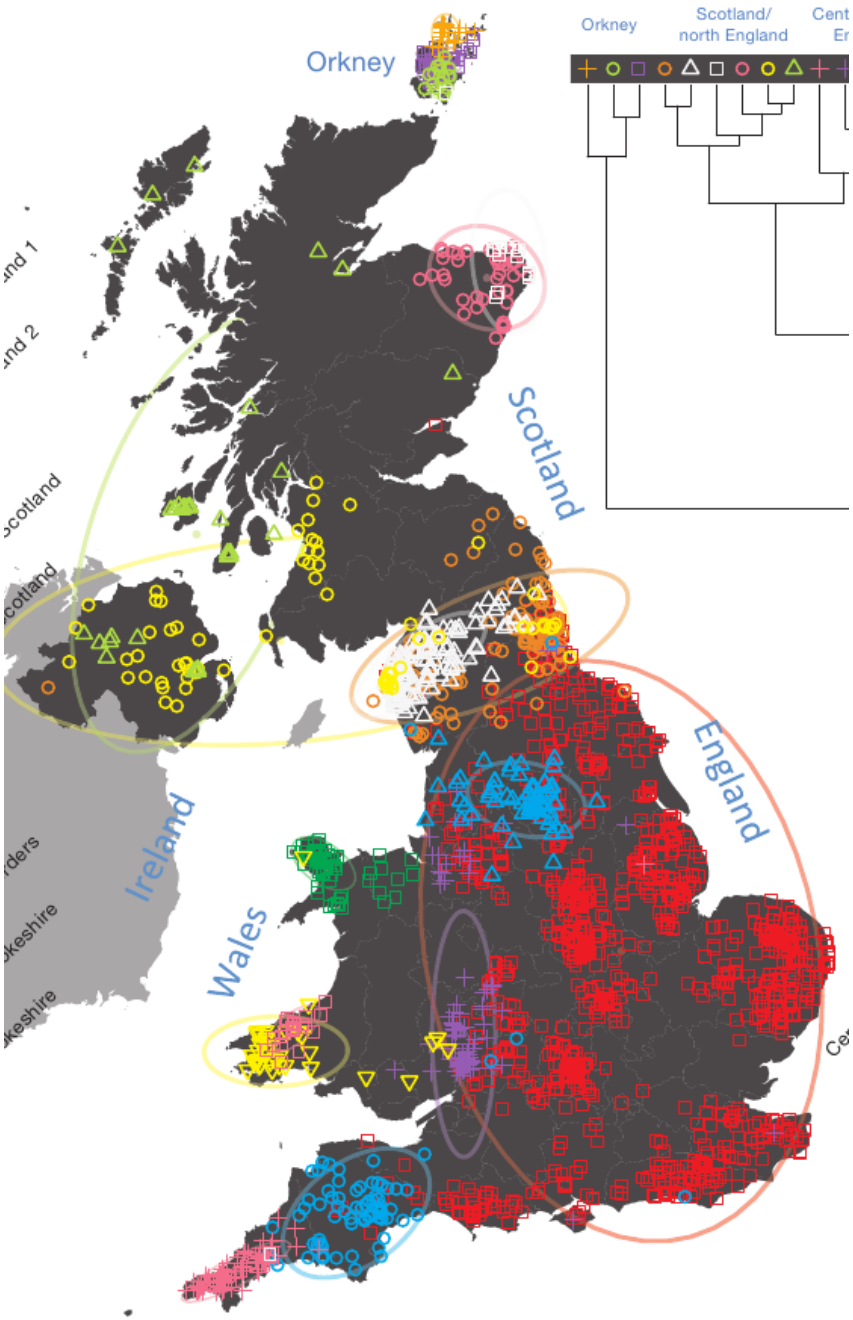
Colors indicate genetically similar groups.

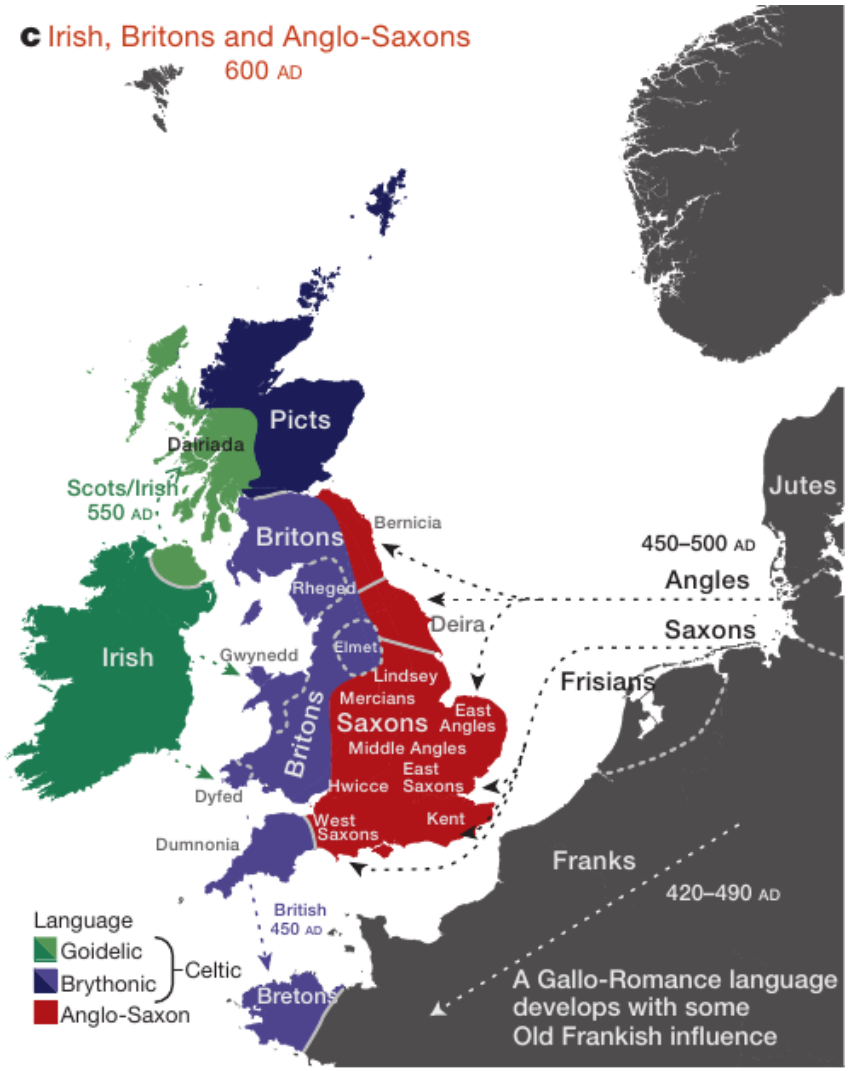

Orkney
Scotland/
north England
Orkney
Scotland
England
Wales
Ireland

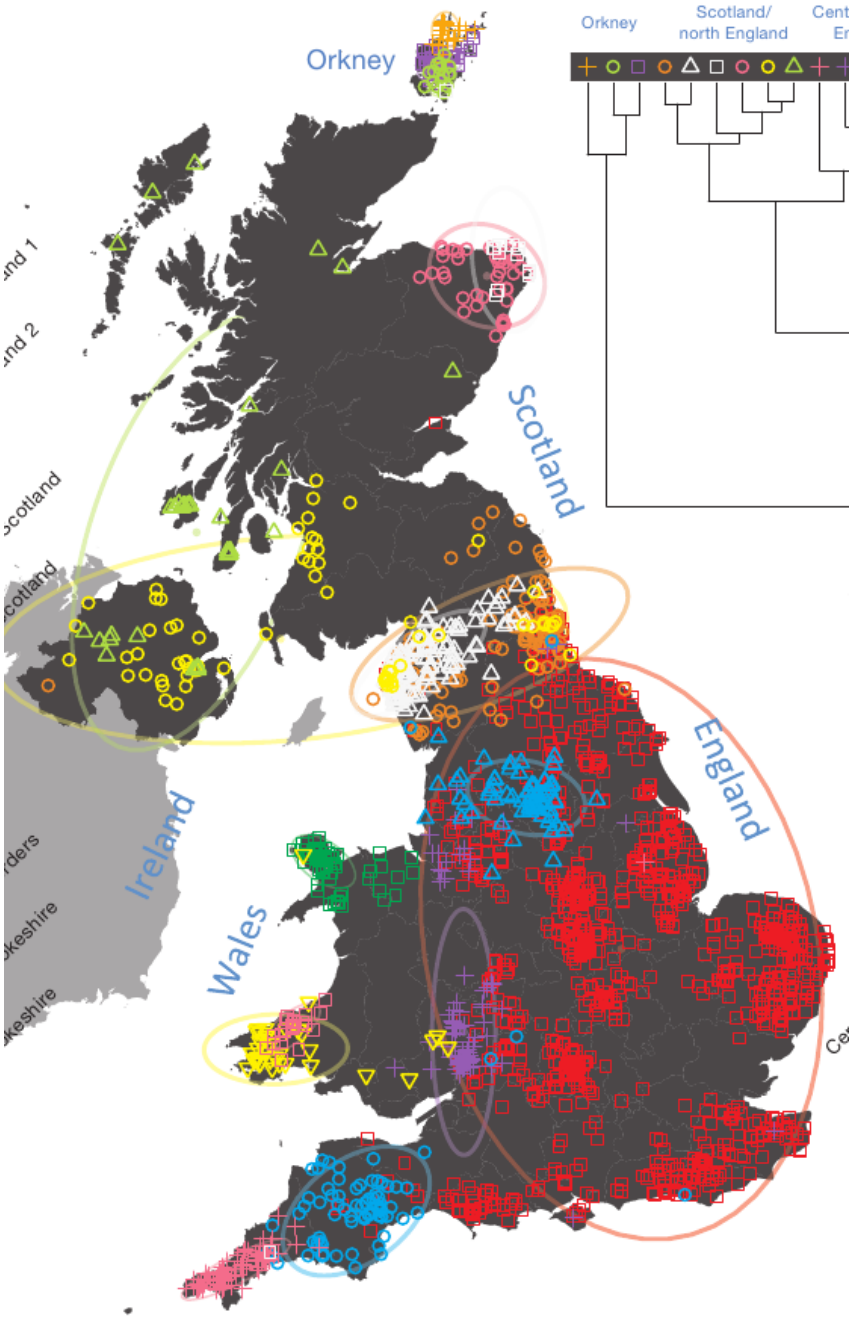

a First settlers after the Ice Age
End of the Paleolithic–Early Mesolithic
9600–7500 BC
Ireland by
8000 BC
Doggerland
Colonization
by land, 9600 BC
onwards
River
Thames
River
Rhine
Movement along
coast by boat
Coastline ca.
8000 BC


Orkney
Scotland/
north England
Orkney
Scotland
England
Wales
Ireland


b Britain within and beyond the Roman Empire
43–410 AD
Picts
Greatest extent of Roman control
Hadrian's Wall
Irish
Romano-British
Most heavily Romanized area
Germans
Some population movement mostly from Gaul and Rhineland (army veterans settling)
Small-scale population movement throughout the Empire
Romano-Gallic
Rhine: frontier of Roman Empire


Orkney
Scotland/
north England
Orkney
Scotland
England
Ireland
Wales


c Irish, Britons and Anglo-Saxons
600 AD
Picts
Dalriada
Scots/Irish
550 AD
Britons
Bernicia
Rheged
Deira
Elmet
Gwynedd
Irish
Lindsey
Mercians
Saxons
East
Angles
Middle Angles
East
Saxons
Hwicce
West
Saxons
Kent
Britons
Dyfed
Dumnonia
British
450 AD
Breton
Jutes
450–500 AD
Angles
Saxons
Frisians
Franks
420–490 AD
A Gallo-Romance language
develops with some
Old Frankish influence
Language
Goidelic
Brythonic
Celtic
Anglo-Saxon


Orkney
Scotland/
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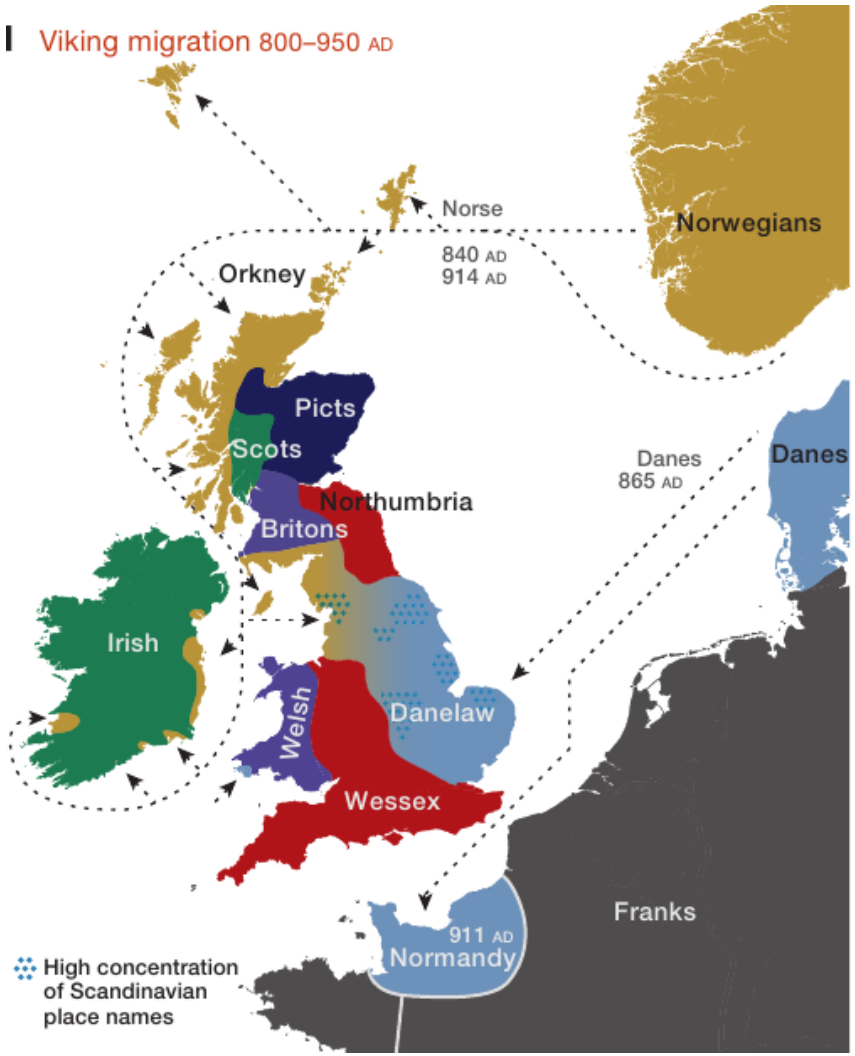
Viking migration 800–950 AD
Norse
840 AD
914 AD
Norwegians
Orkney
Picts
Scots
Northumbria
Britons
Danes
865 AD
Danes
Irish
Welsh
Danelaw
Wessex
Franks
911 AD
Normandy
High concentration
of Scandinavian
place names

Summary

- By distinguishing between long and short IBD blocks, we can examine geographic population structure on different time scales.