



# WE ARE ALL HUMAN...

## The science behind genetic-genealogy

David Ashworth PhD  
Chief Executive



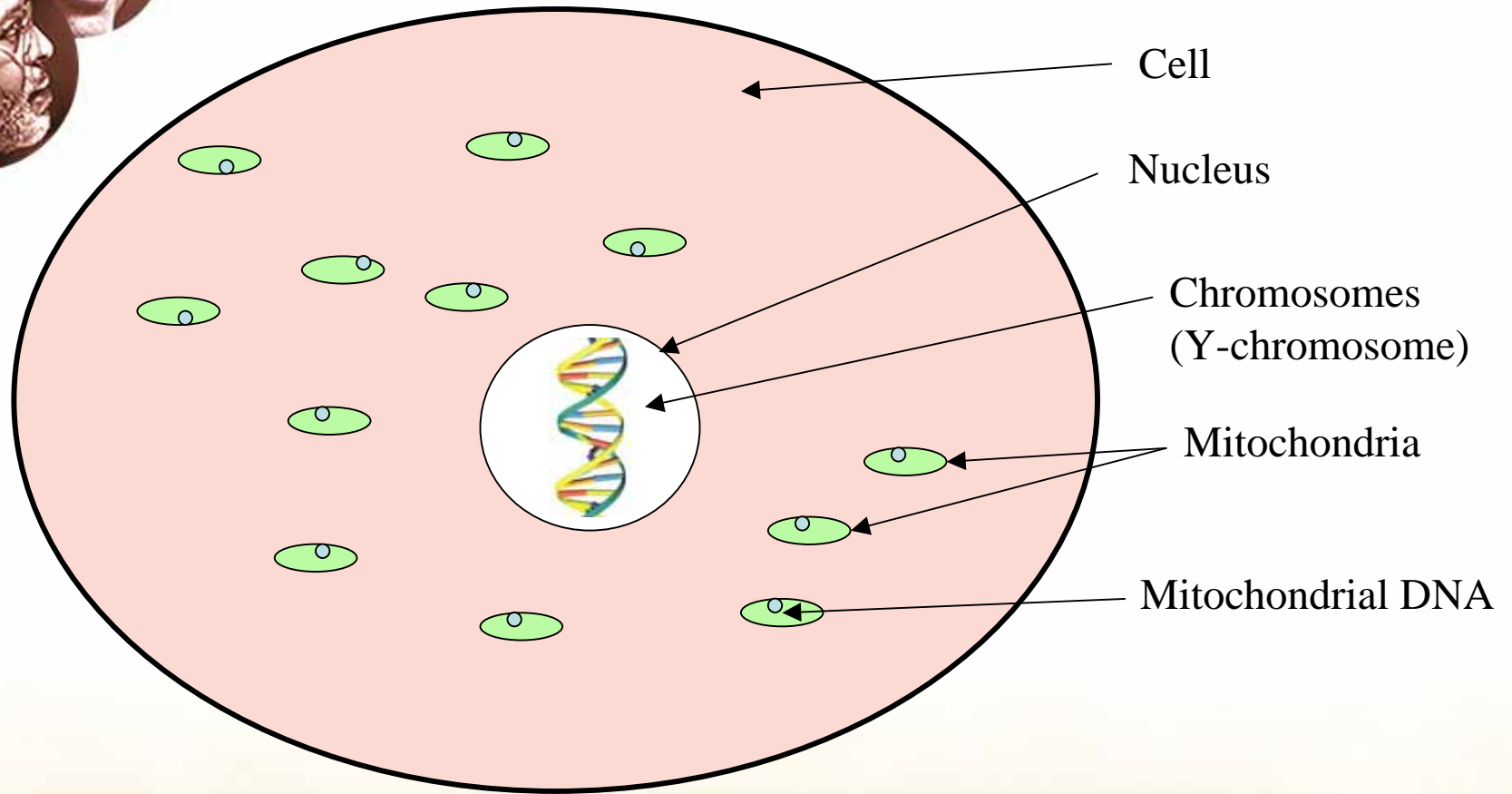
# INTRODUCTION



EXPLORE YOUR GENETIC ROOTS

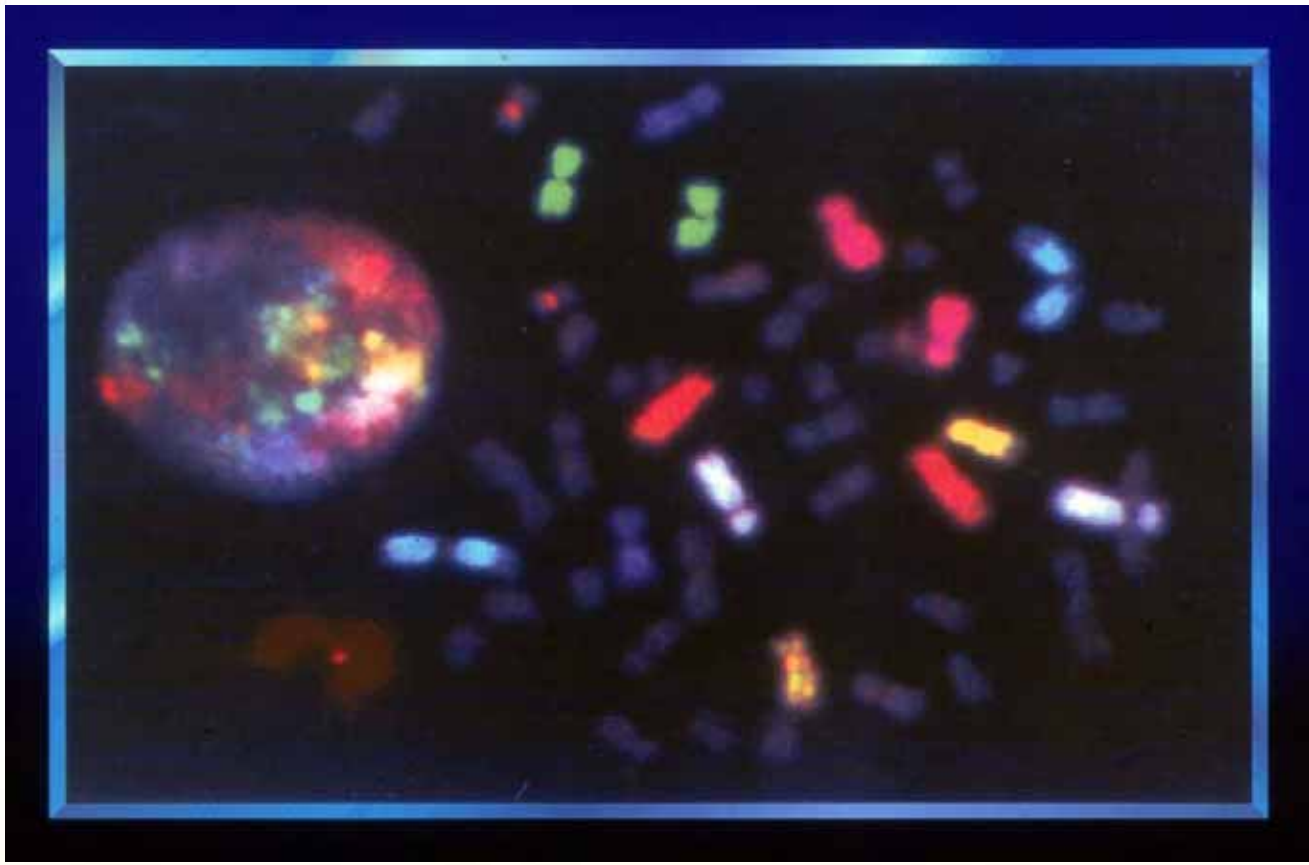


# DNA WITHIN THE CELL

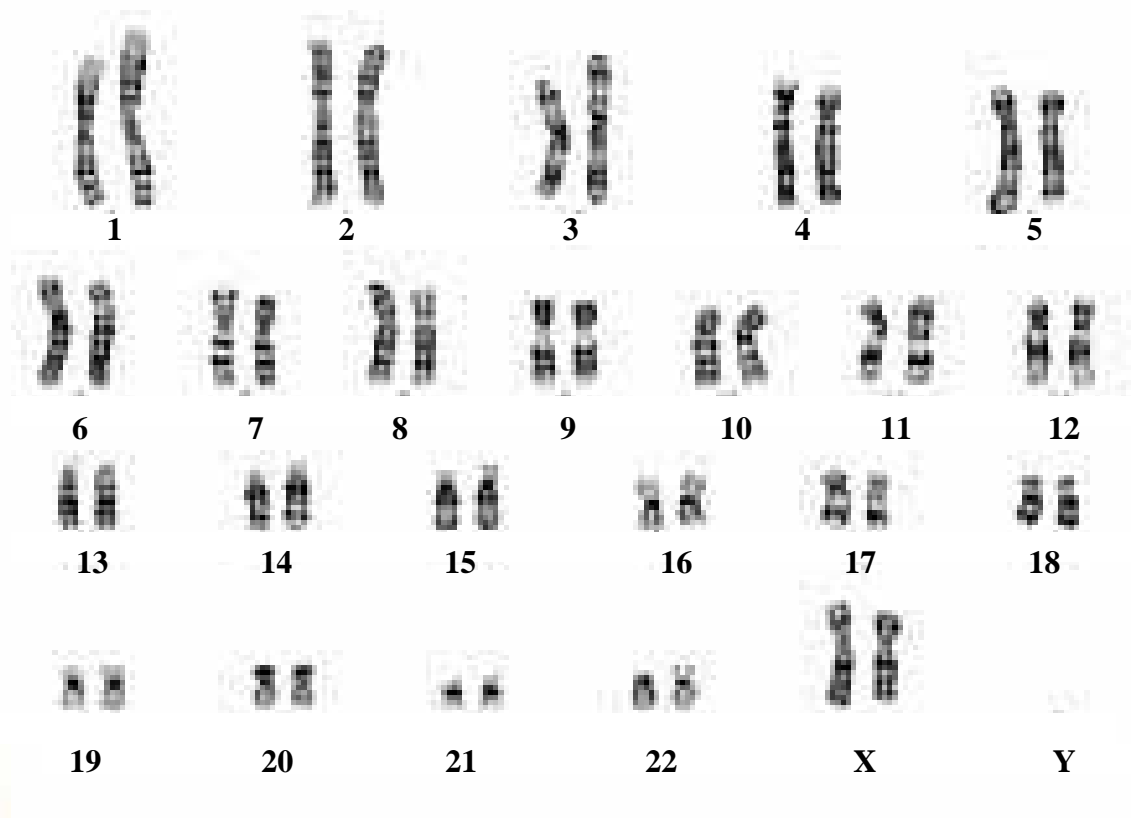


# VISIBLE GENETICS

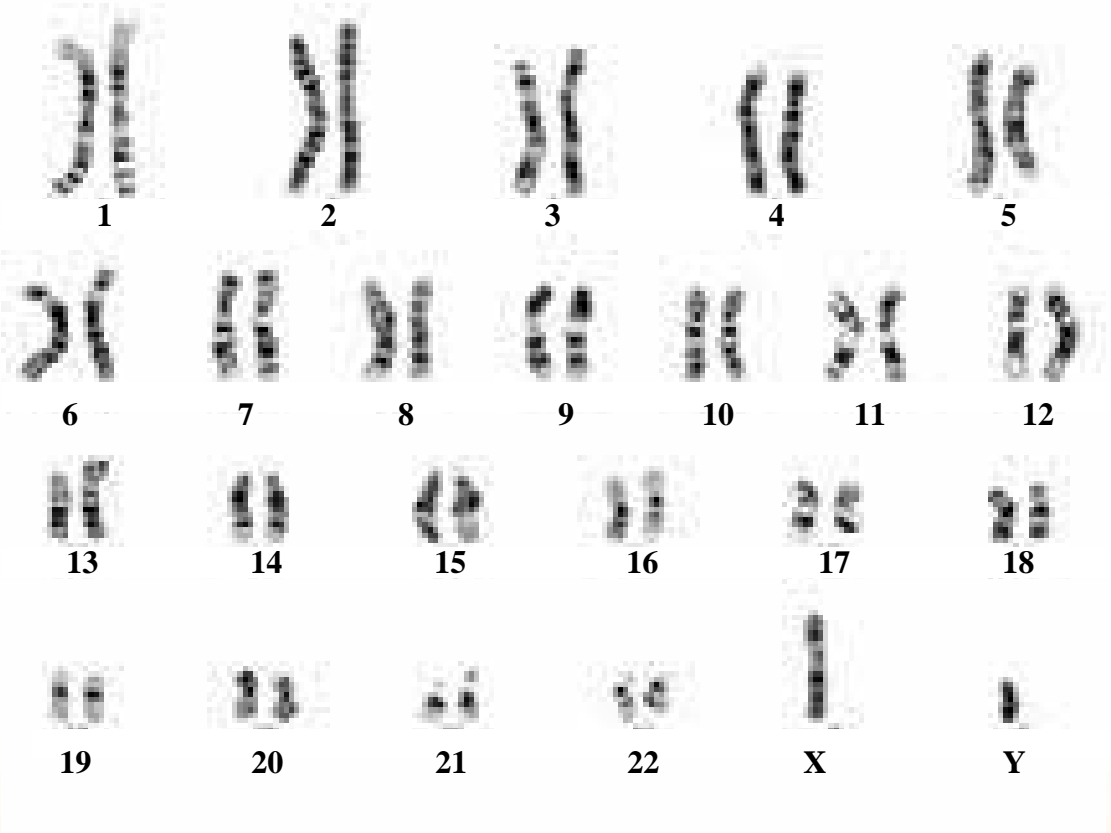
oxford  
ancestors  
EXPLORE YOUR GENETIC ROOTS



# HUMAN FEMALE KARYOTYPE



# HUMAN MALE KARYOTYPE

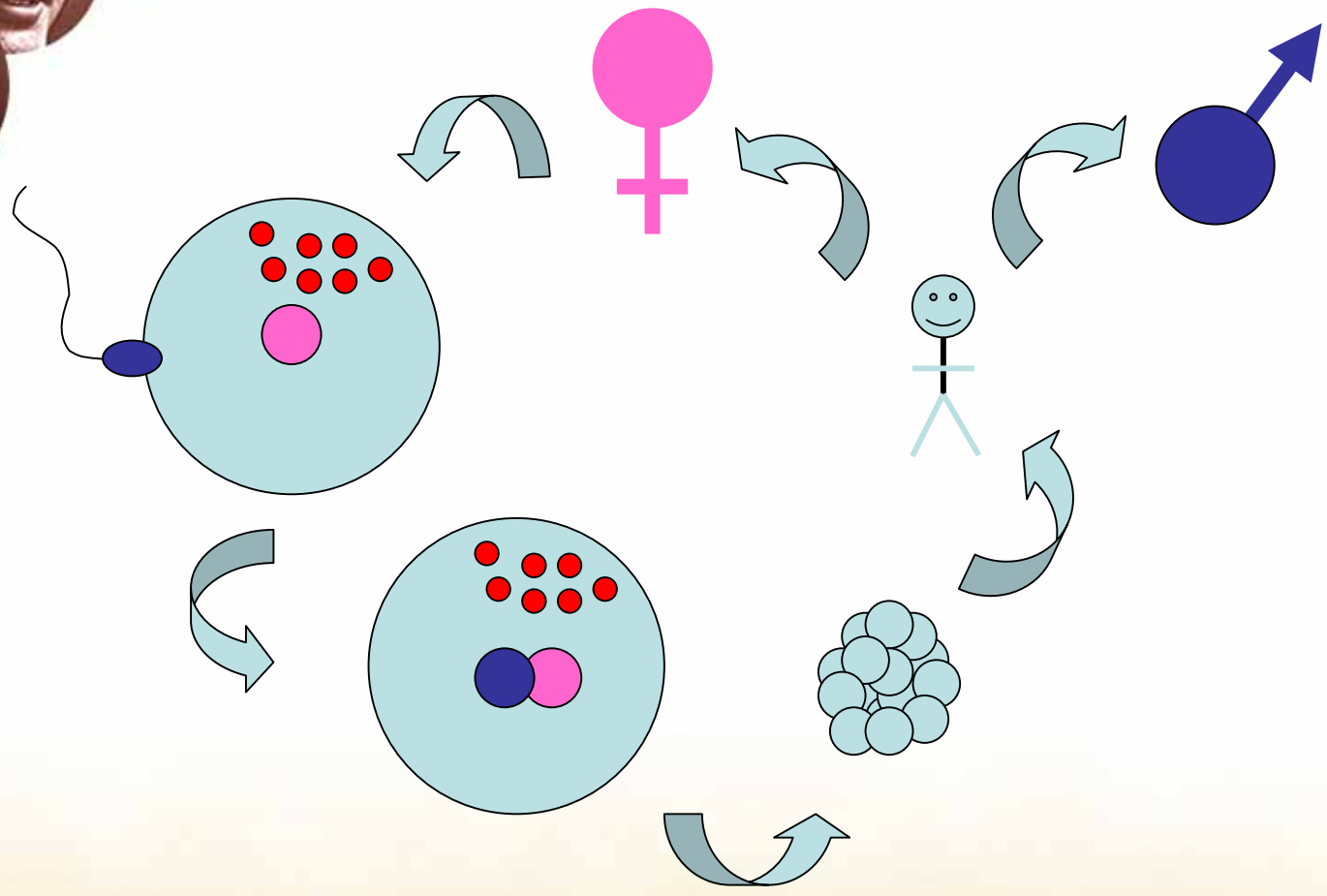


# MITOCHONDRIAL CHROMOSOME

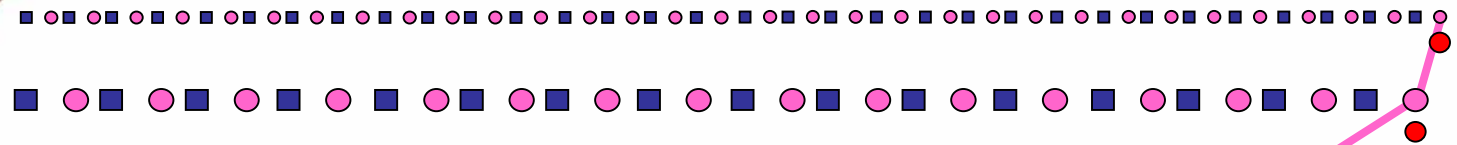
 **oxford**  
ancestors  
EXPLORE YOUR GENETIC ROOTS



# MATERNAL INHERITANCE



# MATERNAL GENEALOGY



Great great grand parents



Great grand parents



Grand parents



Parents



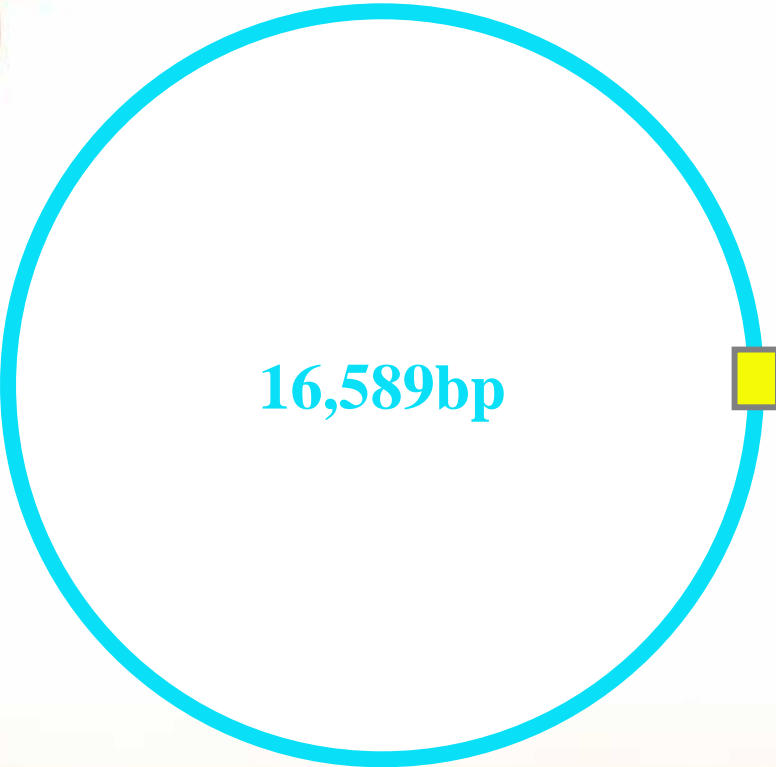
Me



# SAMPLING PROCEDURE



# MITOCHONDRIAL DNA



16,589bp

**Control  
Region 500 bp**

**... AGCCA ... Ref**



**... AGTCA ... Test**



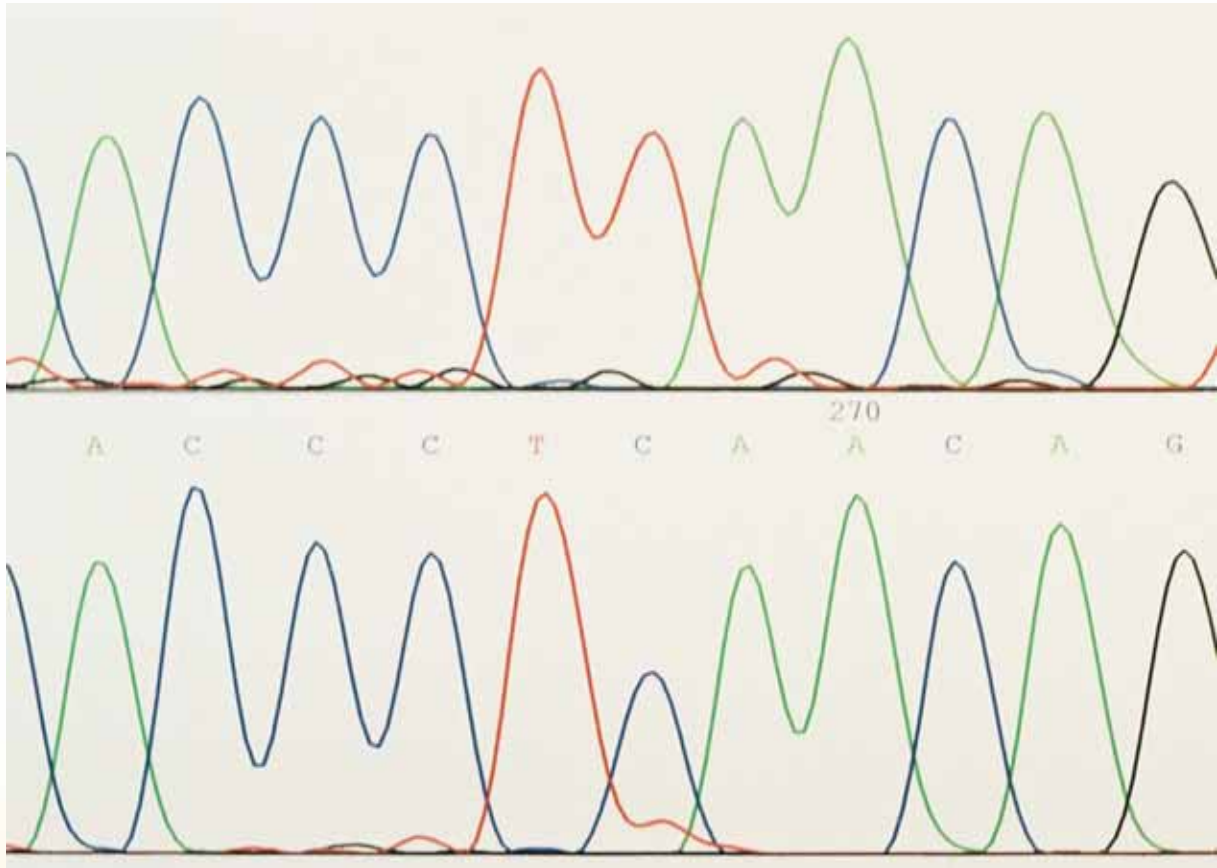
CAMBRIDGE REFERENCE SEQUENCE (CRS)



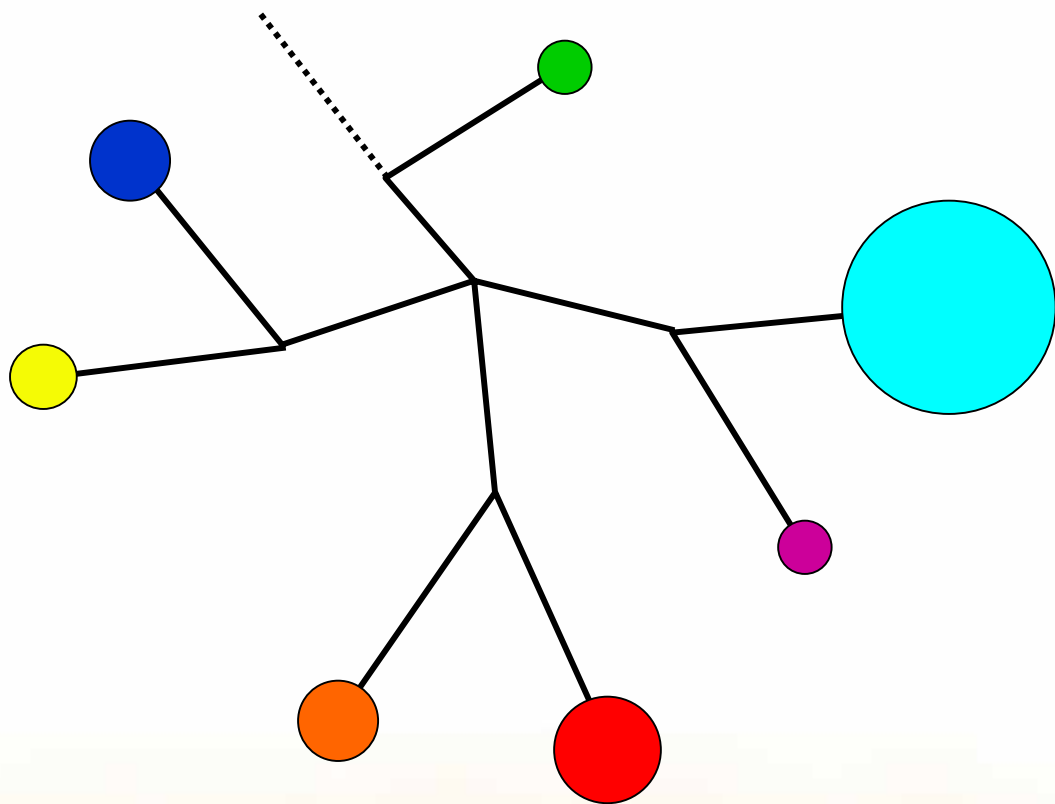
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 TTAGTGCCAG CCACCATGAA TATTGTACGG TACCATAAAT ACTTGACCAC  
 CTGTAGTACA TAAAAACCCA ATCCACATCA AAACCCCTC CCCATGCTTA  
 CAAGCAAGTA CAGCAATCAA CCCTCAACTA TCACACATCA ACTGCAACTC  
 CAAAGCCACC CCTCACCCAC TAGGATACCA ACAAACCTAC CCACCCTTAA  
 CAGTACATAG TACATAAAGC CATTTACCGT ACATAGCACA TTACAGTCAA  
 ATCCCTTCTC GTCCCCATGG ATGACCCCC TCAGATAGGG GTCCCTTGAC



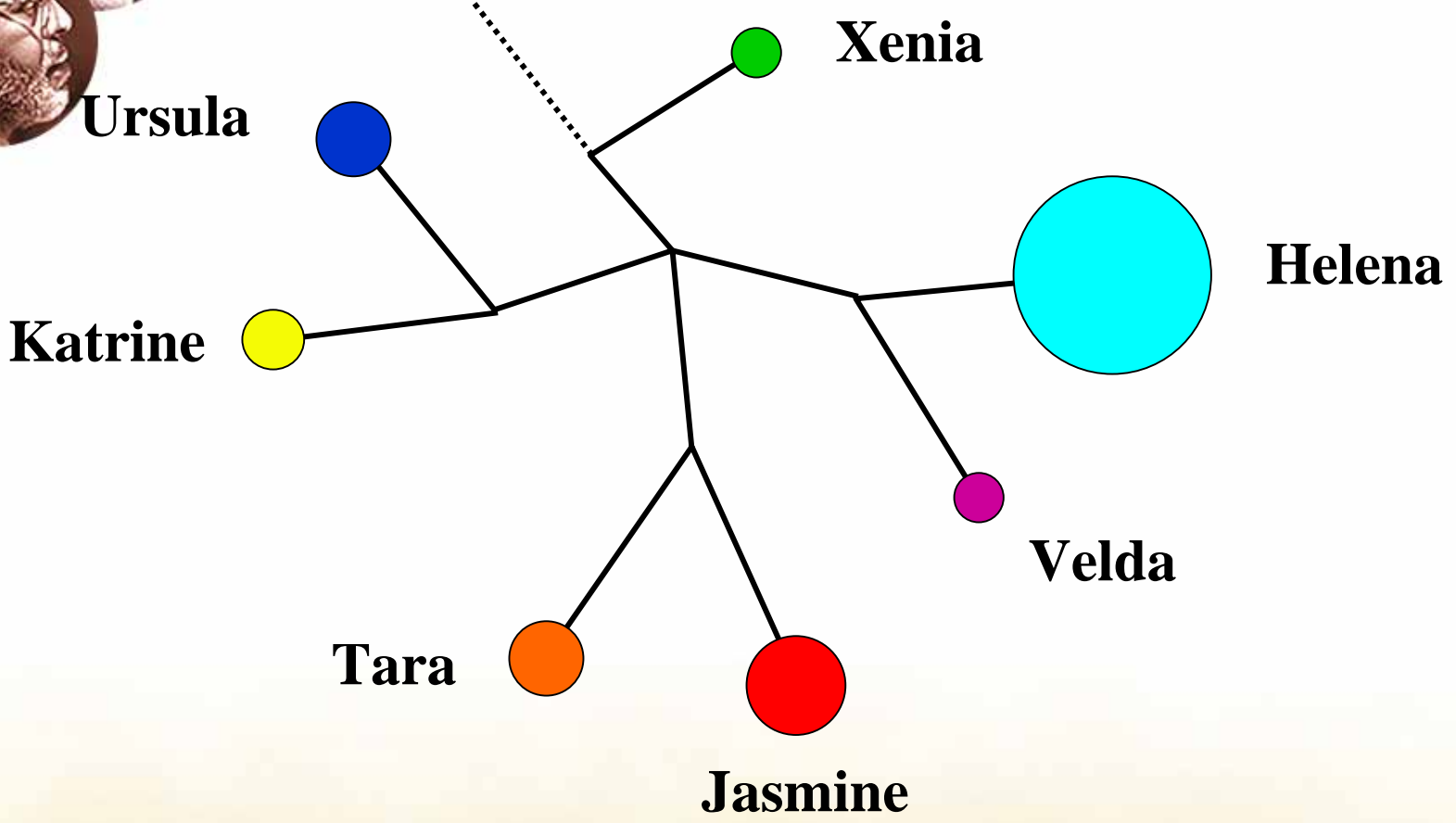
# SEQUENCE COMPARISON



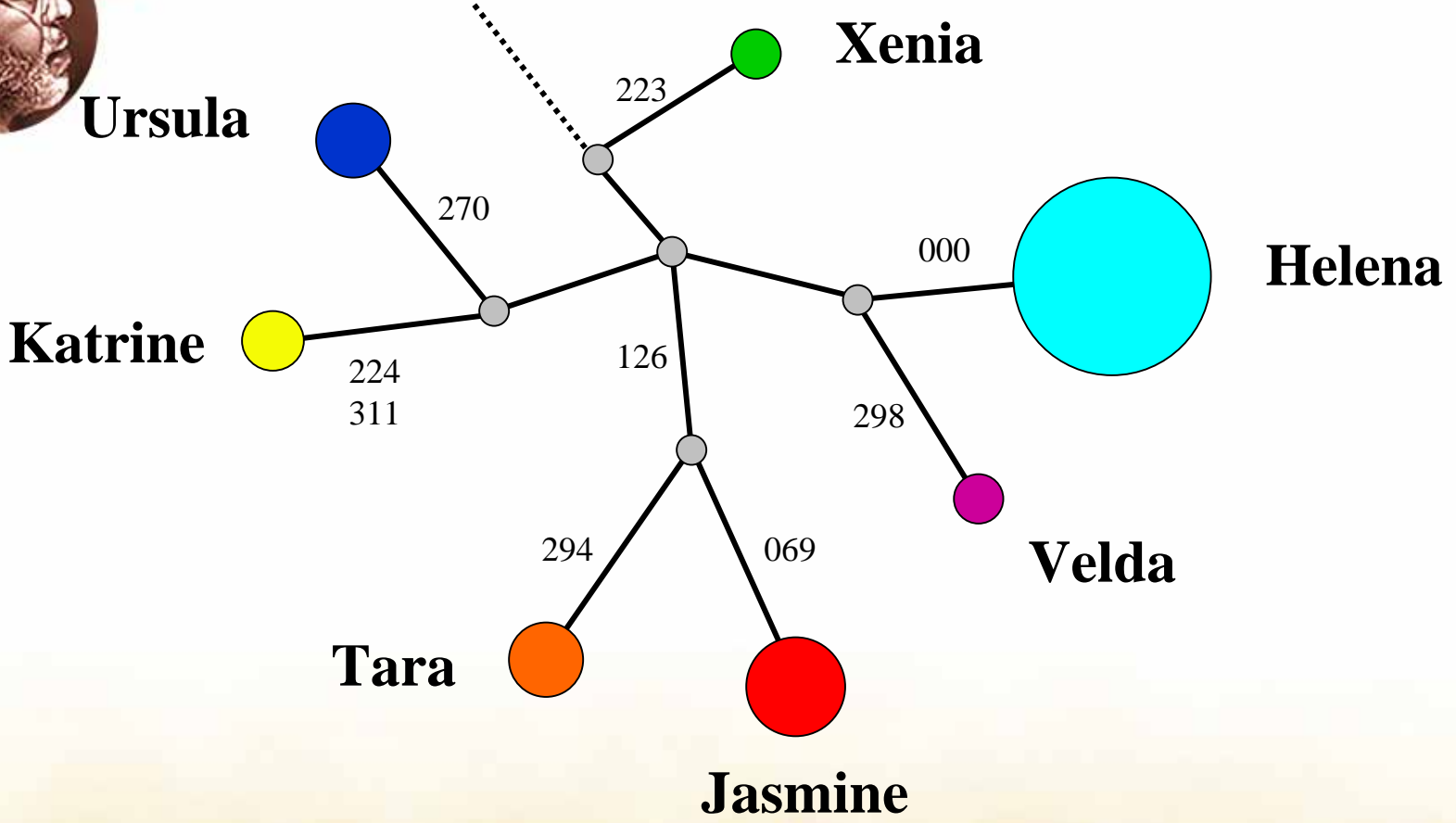
# MAJOR EUROPEAN CLUSTERS



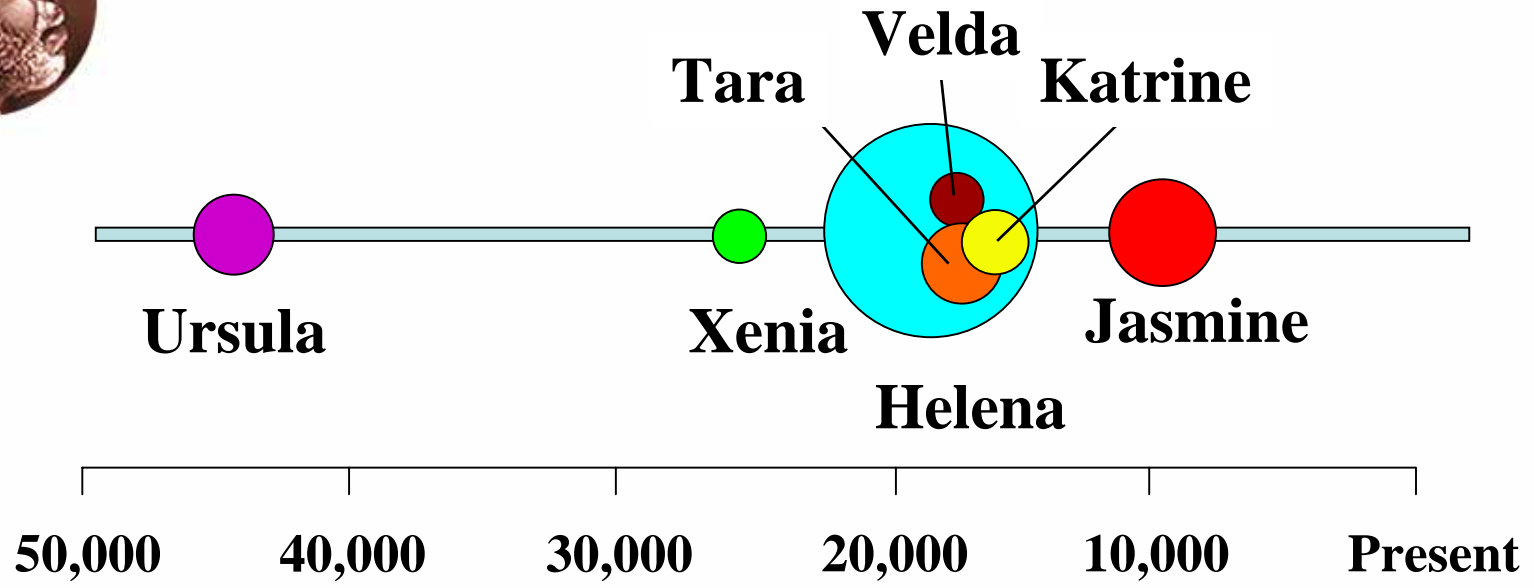
# SEVEN WOMEN



# SEVEN SEQUENCES



# AGE OF THE SEVEN DAUGHTERS



Upper Palaeolithic | Ice Age | Neolithic

Hunters | Farmers



# DAVID'S SEQUENCE

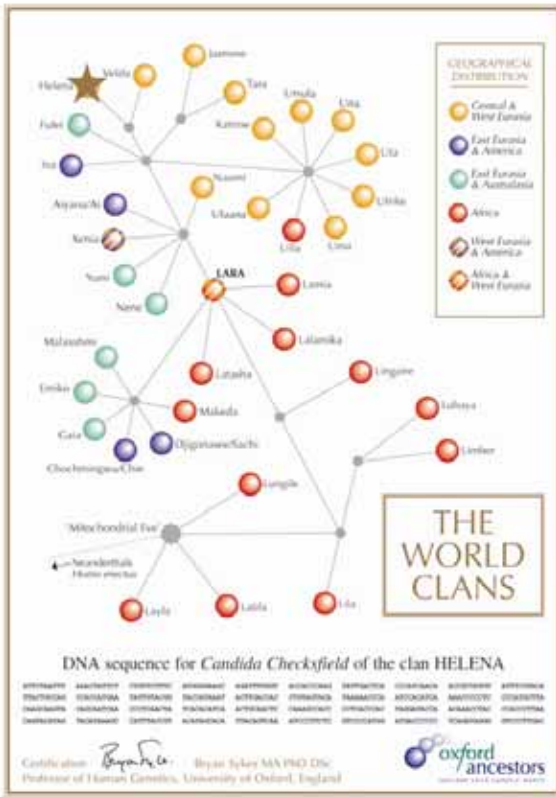


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CTGTAGTACA TAAAAACCCA ATCCACATCA AAACCCCTC CCCATGCTTA  
CAAGCAAGTA CAGCAATCAA CCCTCAACTA TCACACATCA ACTGCAACTC  
CAAAGCCACC CCTCACCCAC TAGGATACCA ACAAACCTAC CCACCCTTAA  
CAGTACATAG TACATAAAGC CATTTACCGT ACATAGCACA TTACAGTCAA  
ATCCCTTCTC GTCCCCATGG ATGACCCCCC TCAGATAGGG GTCCCTTGAC

Descendant of *Helena* (051 162)



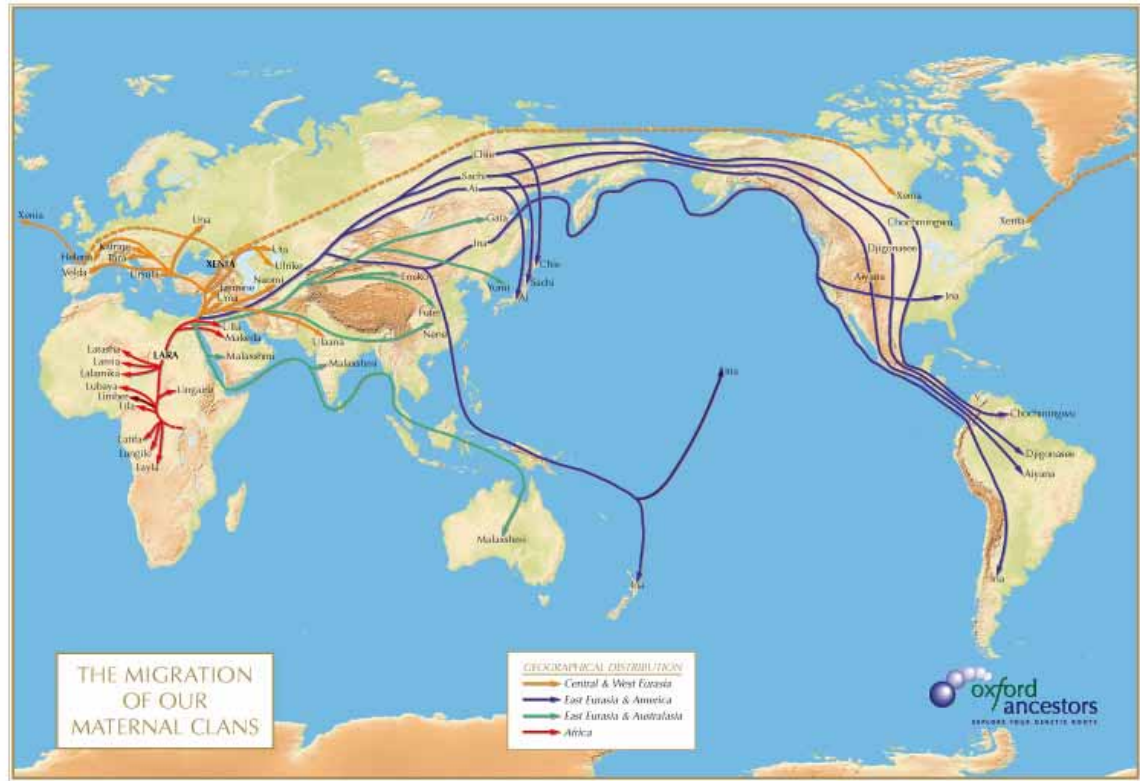
# “OUT OF AFRICA” THEORY



All “non-African” genetic groups appear to be descended from the “Lara” clan, one of three major clades that still exist today in Africa (L1, L2 and L3). This supports the African Eve theory, proposed in the late '80s by biochemist Allan Wilson, Mark Stoneking and others, which states that all humans share a common African ancestor.



# MIGRATION OF *Homo sapiens*



World relief map source: © MAPS & MORE, 2007

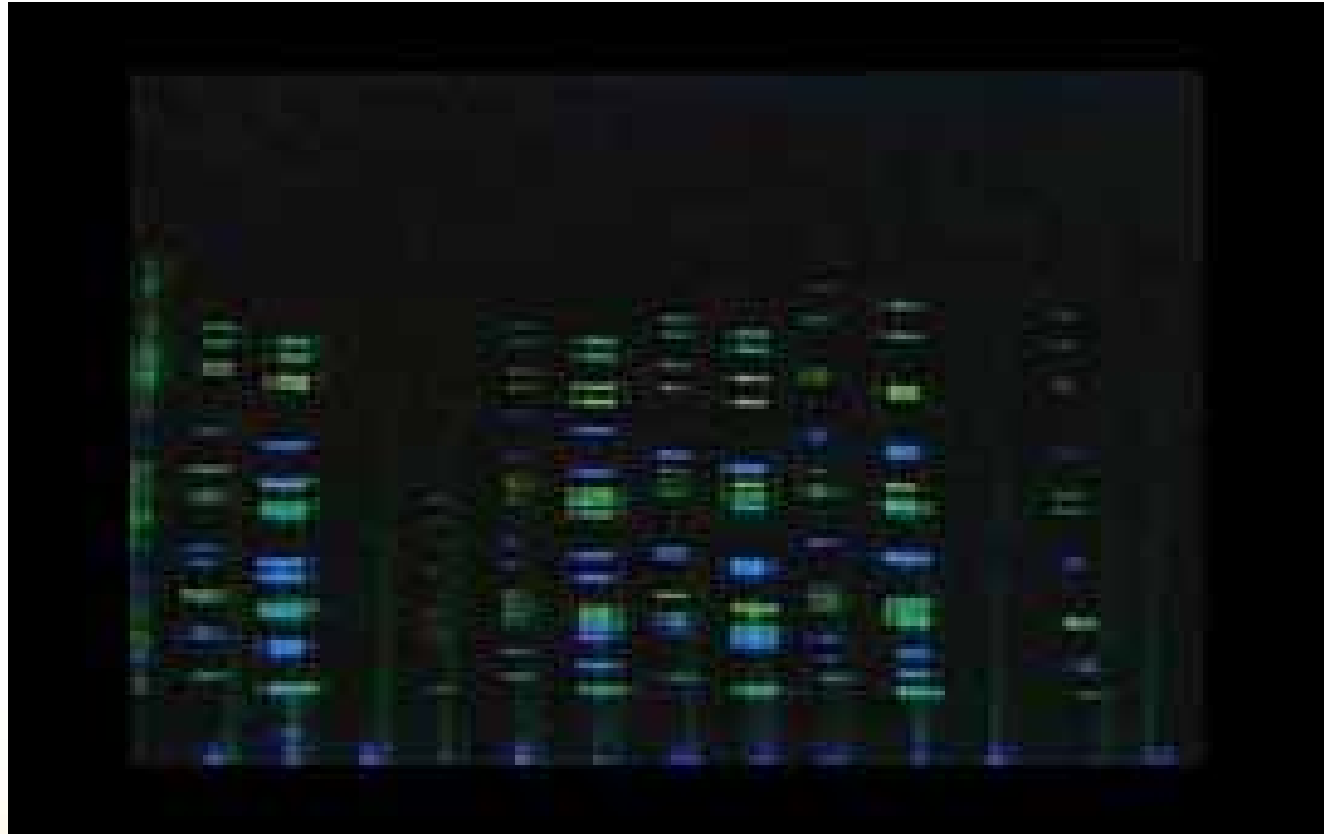
© Oxford Ancestors Limited 2003



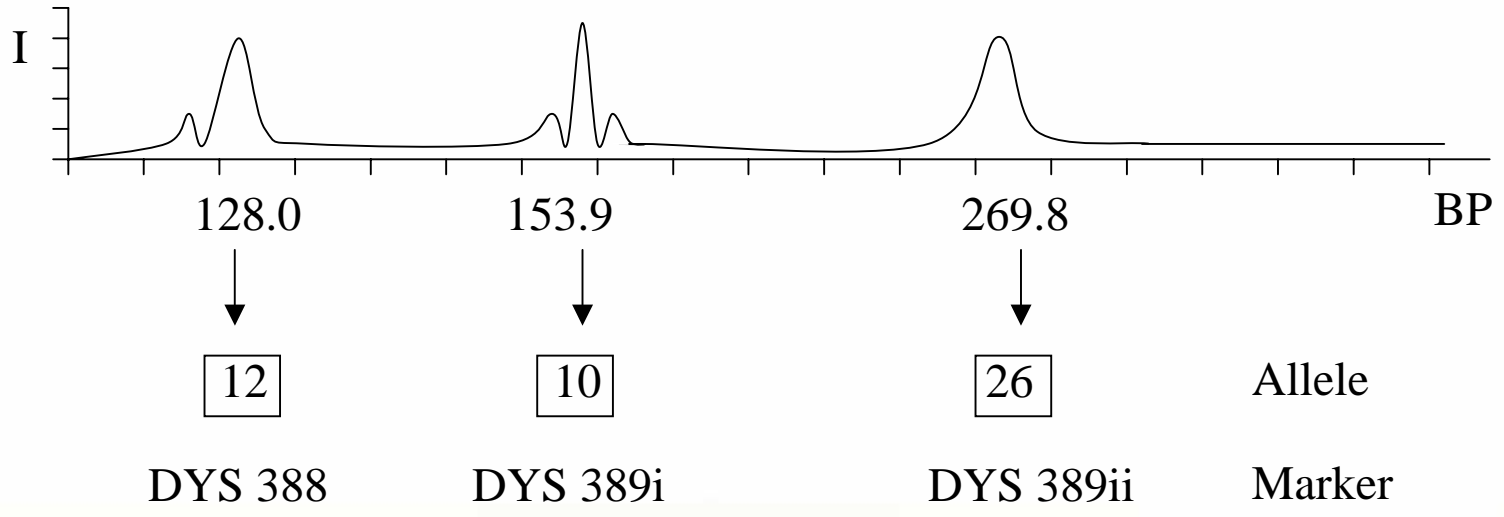
# PCR PRODUCT ANALYSIS



# PCR PRODUCT ANALYSIS



# PCR PRODUCT ANALYSIS



# STR ALLELES



Y-chromosome



DYS 392



GGC-GGC-GGC-GGC-GGC

Repeat units



# TABLE AND DATABASE



	19	388	390	391	392	393	389i	389ii-i	425	426	Frequency	Group
1	14	12	24	11	13	13	10	16	12	12	8.56%	A
2	14	12	24	11	13	13	10	16	12	12		
3	14	12	24	11	13	13	10	16	12	12		
4	15	12	24	11	13	13	10	16	12	12	1.26%	

5	14	13	24	11	12	14	11	16	12	11	0.37%	B
6	14	13	24	11	12	14	11	16	12	11		

7	13	11	22	10	12	14	10	17	13	13	0.05%	C
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# DYSON SURNAME STUDY



Surname	19	388	390	391	392	393	389i	389ii-i	425	426
Dys on	14	14	23	10	11	13	9	16	12	11
Dys on	14	14	23	10	11	13	9	16	12	11
Dys on	14	14	23	10	11	13	9	16	12	11
Dys on	14	14	23	10	11	13	9	16	12	11
Dys on	14	14	23	10	11	13	9	16	12	11
Dys on	14	14	23	10	11	13	9	16	12	11
Dys on	14	14	23	10	11	13	9	16	12	11
Dys on	14	14	23	10	11	13	9	16	12	11
Dys on	14	14	23	10	11	13	9	16	12	11
Dys on	14	13	23	10	11	13	9	16	12	11
Dys on	14	14	21	10	11	13	9	16	12	11
Dys on	14	14	21	10	11	13	9	16	12	11
Dys on	14	14	23	11	11	13	9	16	12	11
Dys on	14	14	23	10	11	13	9	17	12	11
Dys on	14	14	23	10	11	13	9	17	12	11
Dys on	14	14	23	10	11	13	9	17	12	11
Dys on	15	14	23	10	11	13	9	16	12	11
Dys on	15	14	23	10	11	13	9	16	12	11
Dys on	15	14	23	10	11	13	9	16	12	11
Dys on	15	14	23	10	11	13	9	16	12	11
Dys on	14	12	24	11	13	13	10	16	12	12
Dys on	15	12	24	11	13	13	10	16	12	12



# LOCKWOOD STUDY



Surname	19	388	390	391	392	393	389i	389ii-i	425	426
Lockwood	14	12	23	12	13	13	10	16	12	12
Lockwood	14	12	24	10	13	13	10	16	12	12
Lockwood	14	12	24	10	13	13	10	16	12	12
Lockwood	14	12	24	11	13	13	10	16	12	14
Lockwood	14	12	24	11	13	13	10	16	12	14
Lockwood	14	12	24	11	13	13	11	16	12	12
Lockwood	14	12	25	10	13	13	10	16	12	12
Lockwood	14	14	22	10	11	14	9	16	12	11
Lockwood	14	14	22	10	11	14	9	16	12	11
Lockwood	14	14	22	10	11	14	9	16	12	11
Lockwood	14	14	22	10	11	14	9	16	12	11
Lockwood	14	14	22	10	11	14	9	16	12	11
Lockwood	14	14	22	10	11	14	9	16	12	11
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Lockwood	14	14	22	10	11	13	9	16	12	11
Lockwood	14	14	22	10	11	13	9	16	12	11
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Lockwood	15	13	23	10	12	14	10	16	12	11
Lockwood	16	13	23	10	12	13	10	16	12	11
Lockwood	16	13	23	10	12	13	10	16	12	11




# US LOCKWOOD STUDY



Surname	19	388	390	391	392	393	389i	389ii-i	425	426
Lockwood	14	12	23	12	13	13	10	16	12	12
Lockwood	14	12	24	10	13	13	10	16	12	12
Lockwood	14	12	24	10	13	13	10	16	12	12
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Lockwood	14	14	22	10	11	13	9	16	12	11
Lockwood	14	14	22	10	11	13	9	18	12	11
Lockwood	15	13	23	10	12	14	10	16	12	11
Lockwood	16	13	23	10	12	13	10	16	12	11
Lockwood	16	13	23	10	12	13	10	16	12	11
Lockwood	14	14	22	10	11	14	9	16	12	11
Lockwood	14	14	22	10	11	14	9	16	12	11



- 
- DNA analysis must only be used to test an existing genealogical hypothesis
  - DNA analysis results provide supporting evidence *or otherwise* for that hypothesis
  - Constructing a hypothesis (reconstructing a family tree) from DNA evidence is *unsafe*
  - Early 1990s – “Prosecutor’s fallacy”
  - All DNA evidence is *probabilistic*



# PATERNAL GENEALOGY



Somerled

Dugall

Ranald

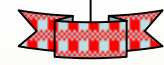
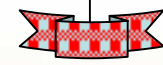
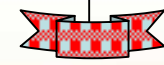
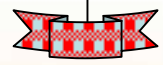
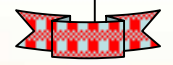
Angus

MacDougall

Donald  
of Islay

Alastair

John, Lord of the Isles

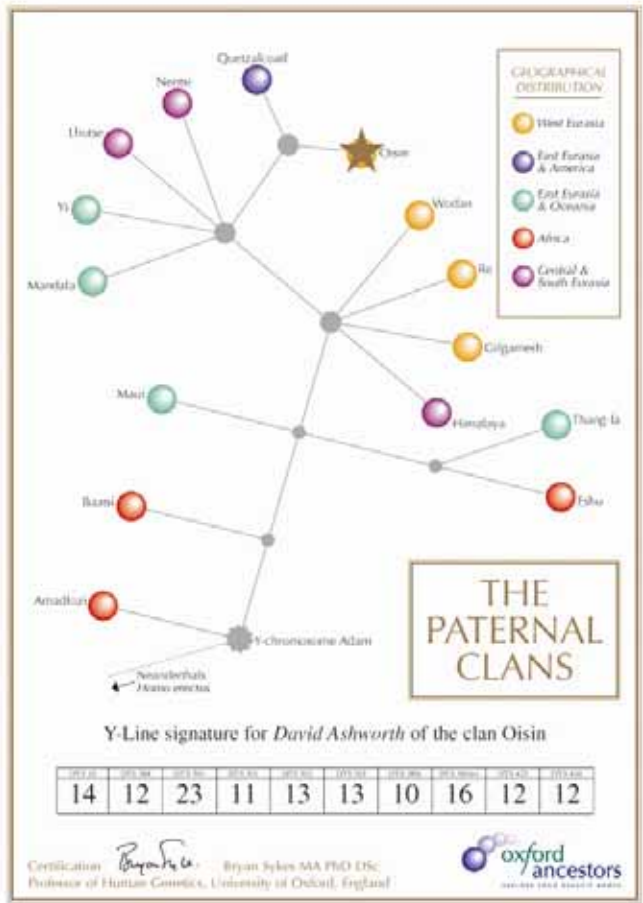


MacAlastair

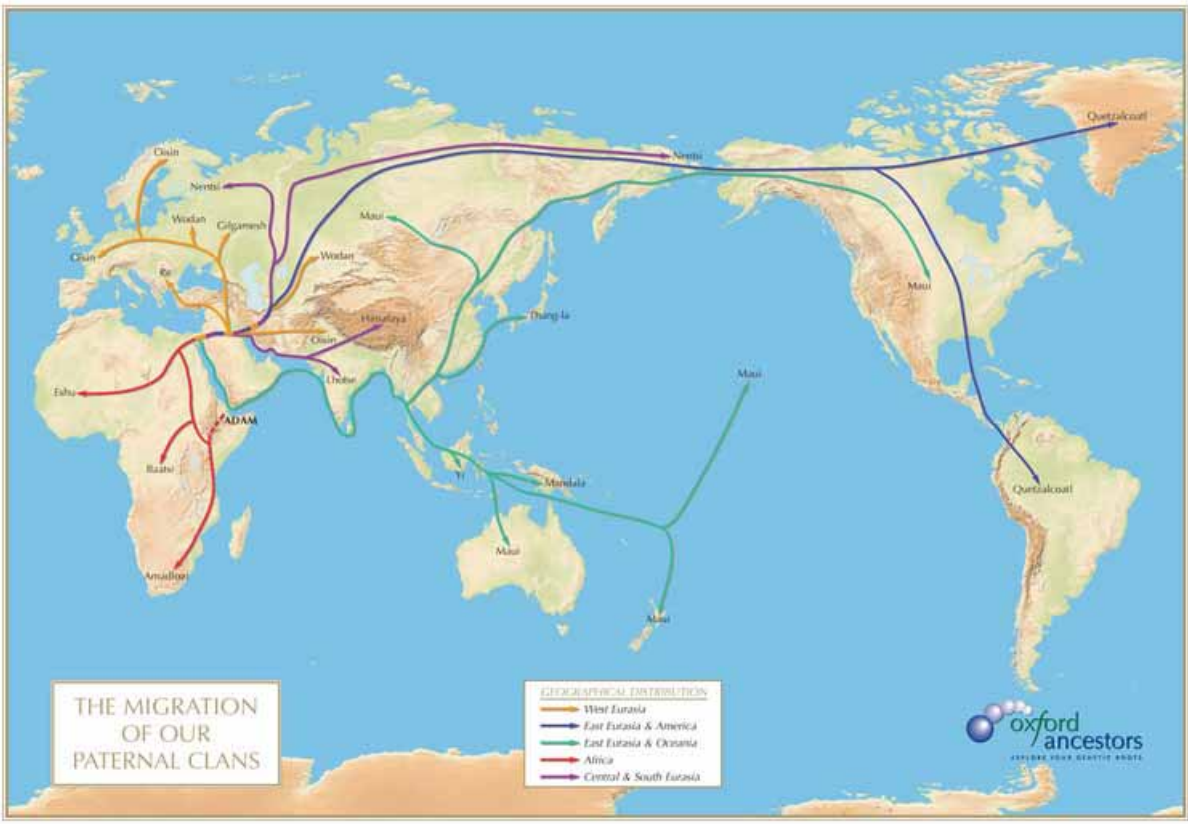
Macdonald



# PATRILINE CERTIFICATE



# MIGRATION OF *Homo sapiens*



World relief map image © MAPS IN MINUTE™ 2003

PM01 © Oxford Ancestors Limited 2004



# THE WORLD POPULATION



- In 1600, the Earth's population was 600 million.
- That is about 13 generations between 1600 and 2004.
- Each of us has 4,096 10th great grandparents.
- At 1AD, the population was 300 million.
- That's 67 generations ago.
- If each of our 64th great grandparents were unique, each of us would have approximately  $7.4 \times 10^{19}$  ancestors at 1AD.
- $2.5 \times 10^{11}$  times the human population of the earth at that time!



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oxford  
ancestors

EXPLORE YOUR GENETIC ROOTS

