

# Computing in Medicine

Instructor: Dmitri A. Gusev

Fall 2007

CS 210: Computing and Culture

Discussion 3, September 26, 2007

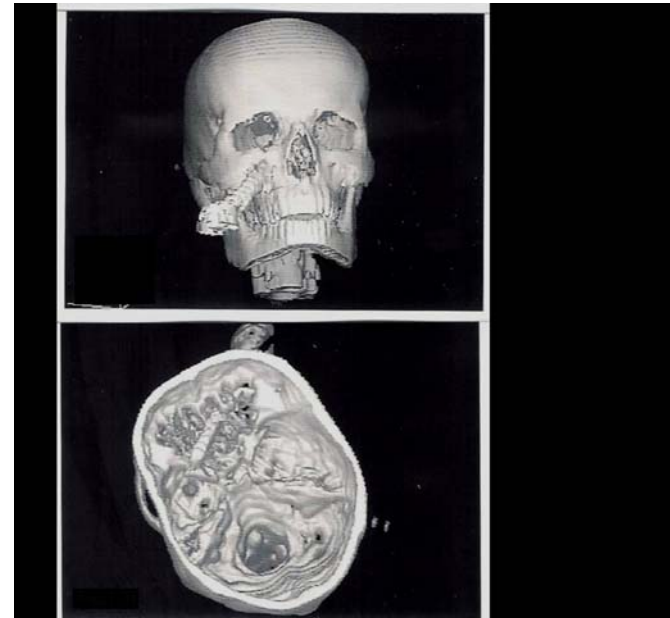
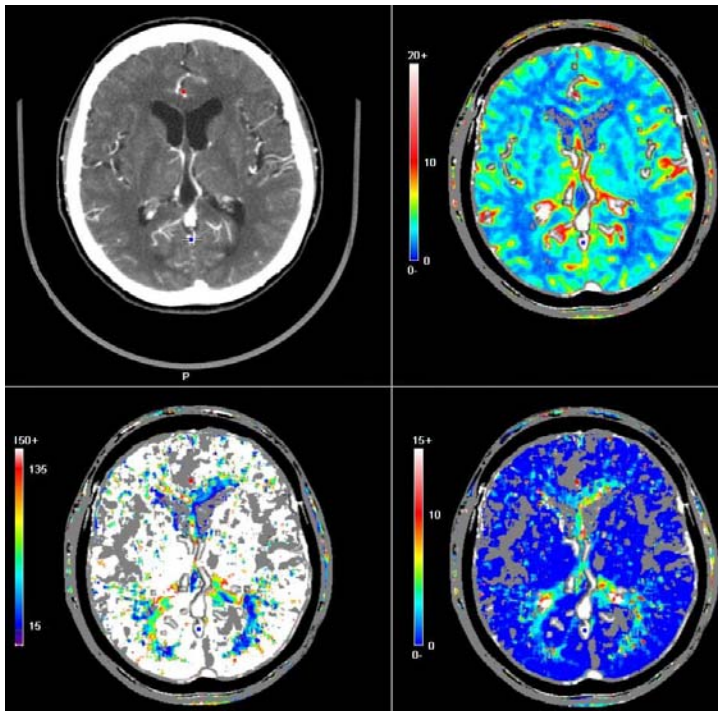
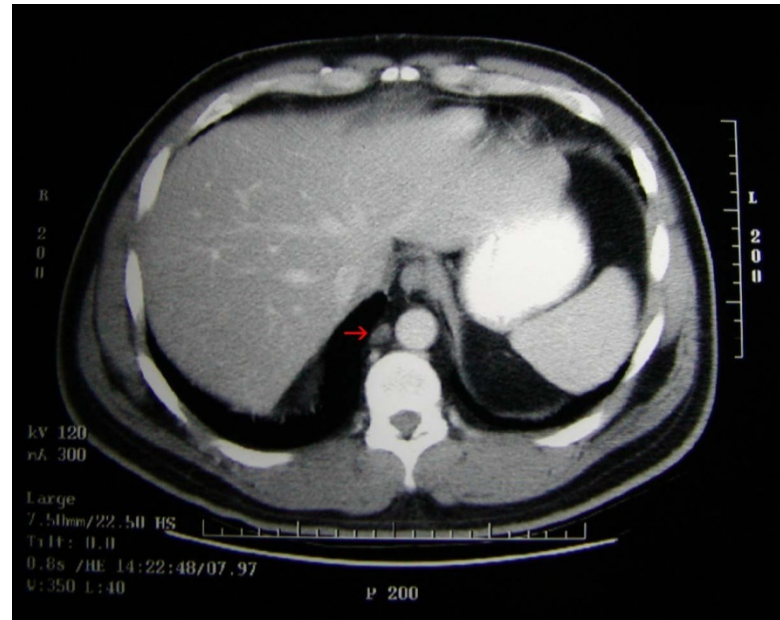
# Ultrasonography

- Medical ultrasonography is an ultrasound-based diagnostic imaging technique used to visualize muscles and internal organs.
- “Ultrasound“: Acoustic signal with a frequency above the limit of human hearing (20 kilohertz). Typical diagnostic sonographic scanners operate in the frequency range of 2 to 18 megahertz
- Digital sonographic images are used as input to systems for computer-aided diagnostics and computer-assisted surgery



# Computed Tomography

- CT: Digital geometry processing is used to generate a three-dimensional image of the internals of an object from a large series of two-dimensional X-ray images



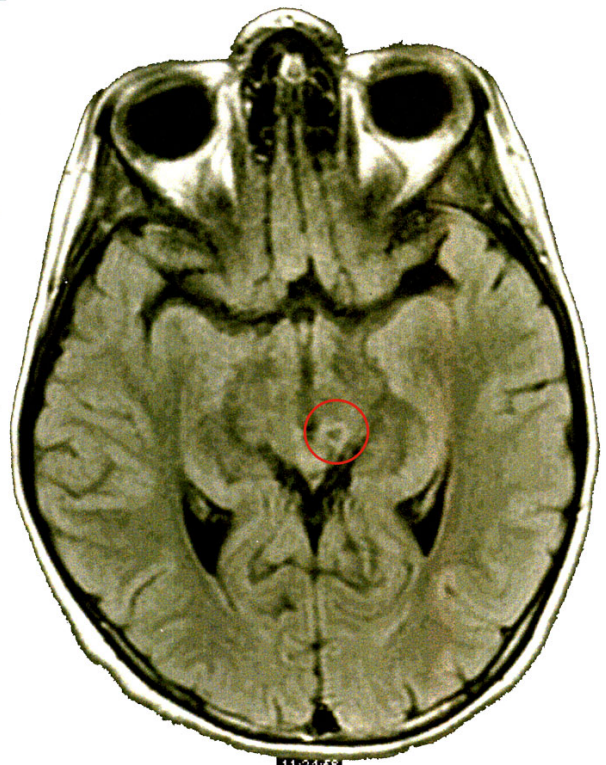
# Magnetic Resonance Imaging (MRI)

- A computed tomography (CT) scanner uses X-rays, a type of ionizing radiation, to acquire its images, making it a good tool for examining bone and calcifications within the body, or structures (vessels, bowels). MRI, on the other hand, uses non-ionizing radio frequency (RF) signals to acquire its images and is best suited for non-calcified tissue. Aided by a computer, MRI is able to produce images from many different body angles and plans, which enables radiologists to quickly and precisely diagnose a wide variety of conditions.

Childrens radiology St Paul  
SENARIGHI ANDRIANA RUTH  
7/27/1994

R

Thickness 5  
FOV 200 mm  
Flip 90 / TI 2200  
NEX 0.5  
TR 8802 / TE 122



11:24:58  
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# Medical Expert Systems

- An expert system is a computer program that contains some of the subject-specific knowledge, along with the formalized knowledge and analytical skills of one or more human experts.

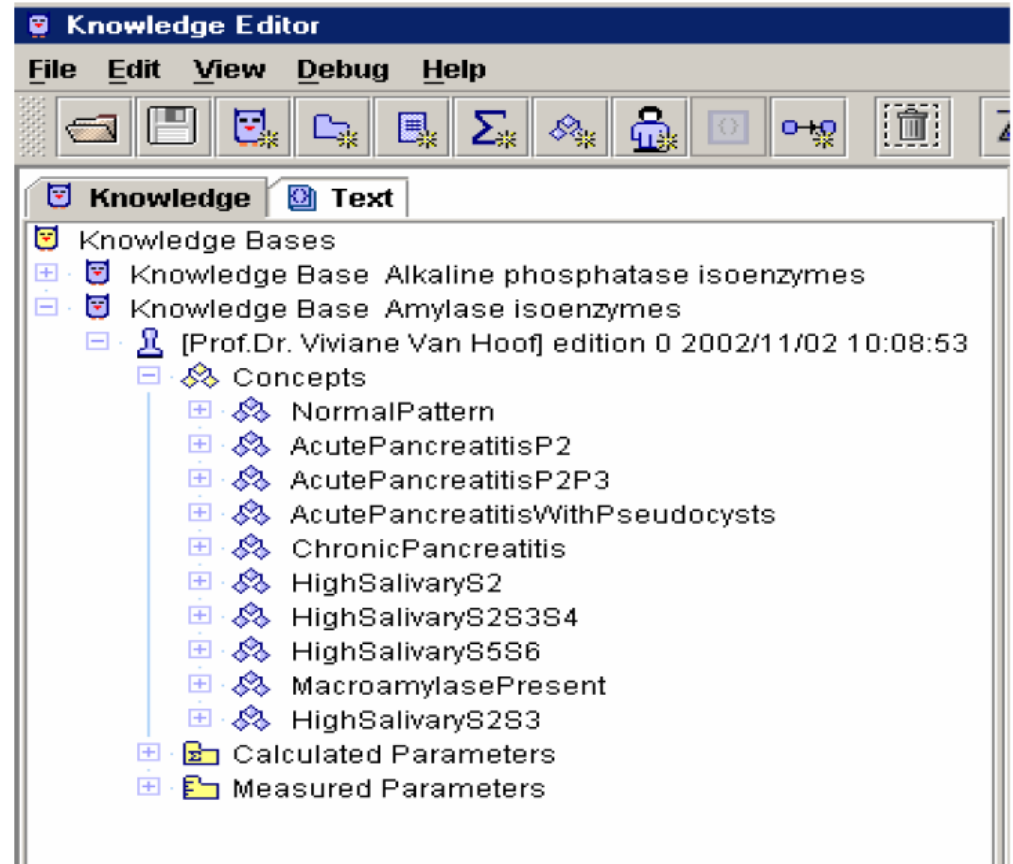


Figure 1 - Concepts that were defined in the j.MD isoamylase knowledge base

# Computer Analysis of Genetic Data

## Tracing Human History Through Genetic Mutations

By examining DNA patterns that are inherited maternally or paternally, scientists can trace human lineages back to the original branches, or sons and daughters, of a genetic Adam and an Eve.

### Europe

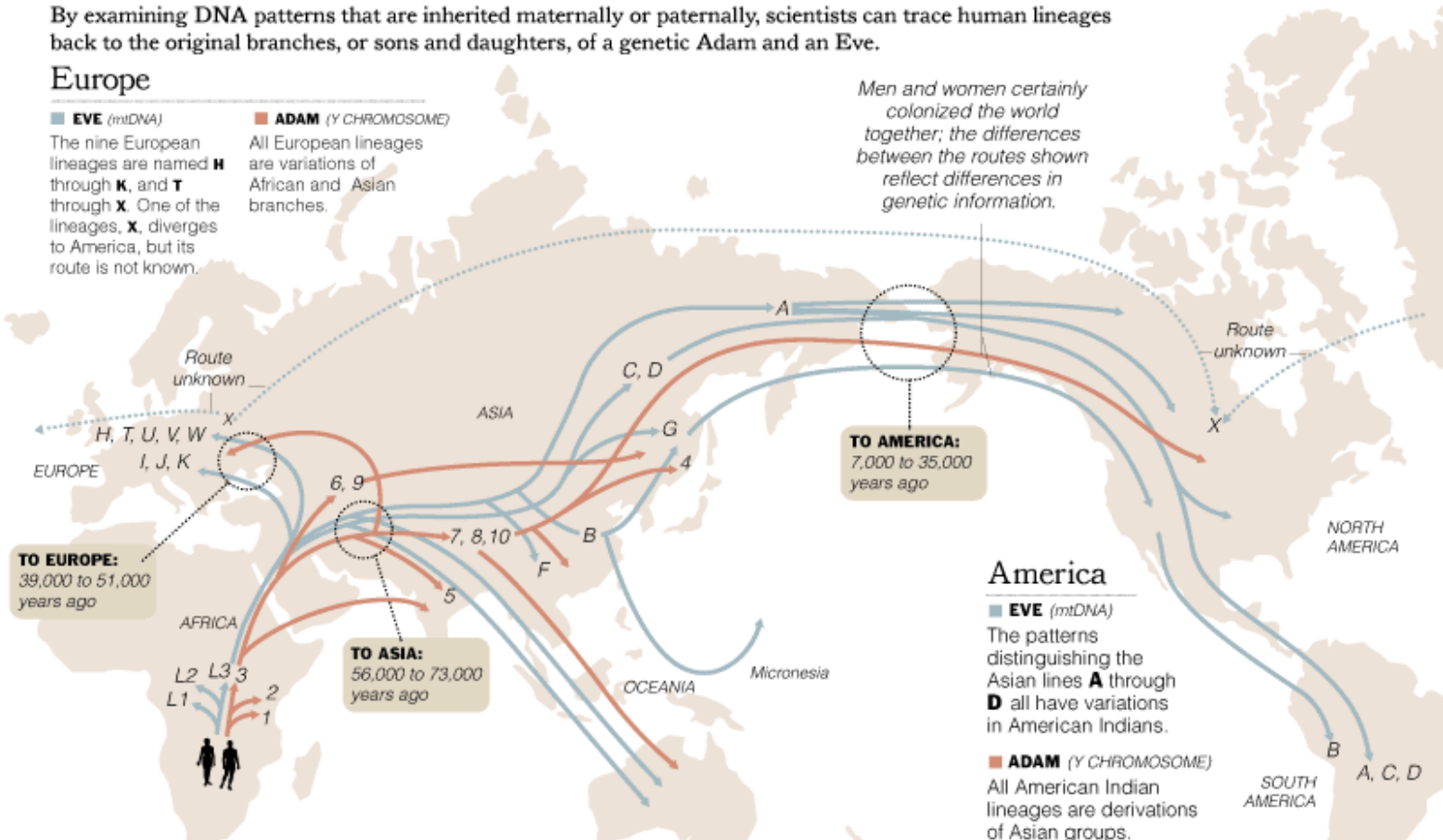
#### EVE (mtDNA)

The nine European lineages are named **H** through **K**, and **T** through **X**. One of the lineages, **X**, diverges to America, but its route is not known.

#### ADAM (Y CHROMOSOME)

All European lineages are variations of African and Asian branches.

Men and women certainly colonized the world together; the differences between the routes shown reflect differences in genetic information.



### Africa

#### EVE (mtDNA)

The three African branches are named **L1** through **L3**, and **L3** separates into all the other branches.

#### ADAM (Y CHROMOSOME)

The three African branches are named **1**, **2** and **3**, and **3** separates into all the other branches.

### Asia

#### EVE (mtDNA)

The six Asian branches are named **A** through **D** and **F** and **G**.

#### ADAM (Y CHROMOSOME)

The seven Asian branches are **4** through **10**, and these groups branch off into Oceania, Europe and America.

### America

#### EVE (mtDNA)

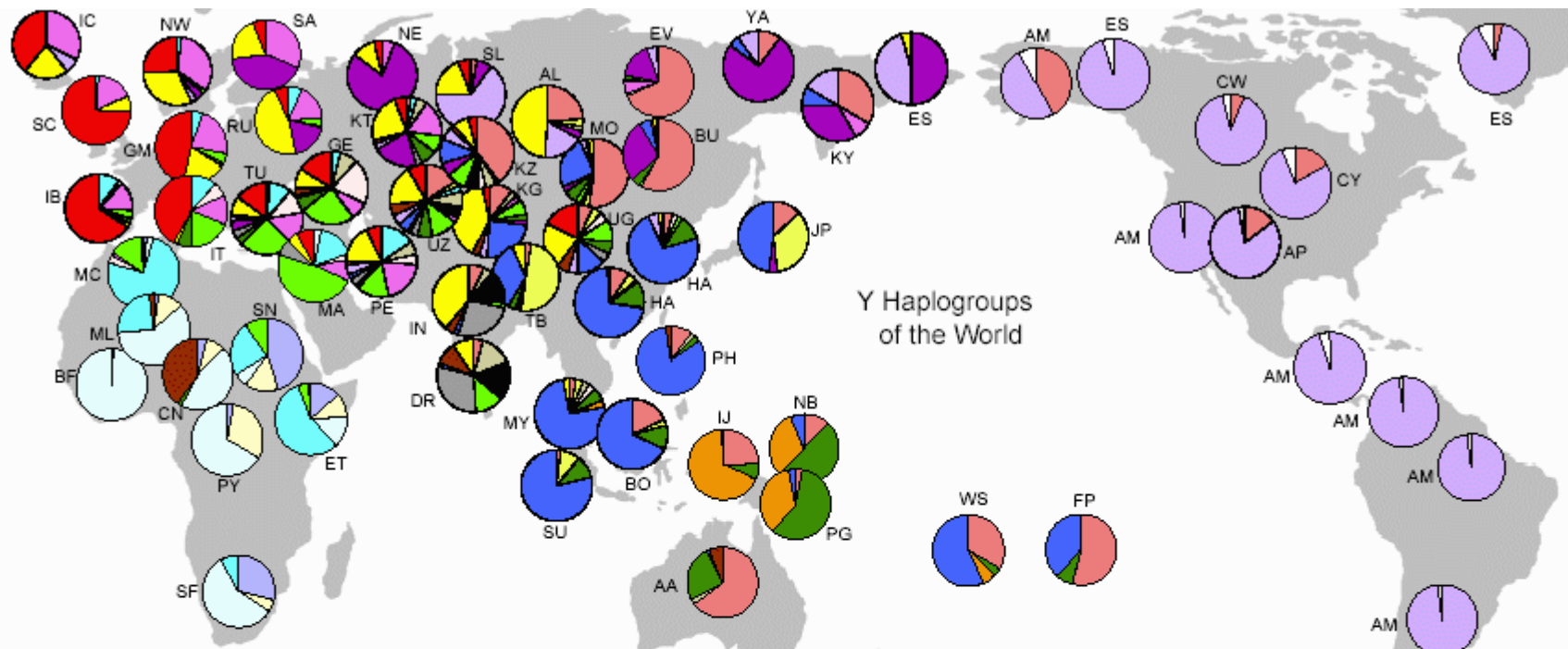
The patterns distinguishing the Asian lines **A** through **D** all have variations in American Indians.

#### ADAM (Y CHROMOSOME)

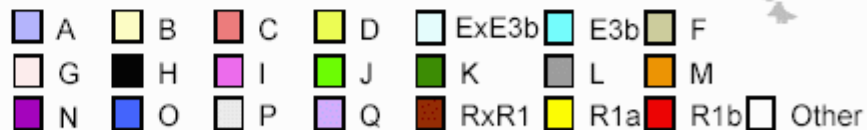
All American Indian lineages are derivations of Asian groups.

Sources: Dr. Douglas C. Wallace, Marie T. Lott, Emory University; Dr. Peter A. Underhill, Stanford University; "Genes, Peoples, and Languages," by Dr. Luca Cavalli-Sforza

# Y-Chromosome Map, World

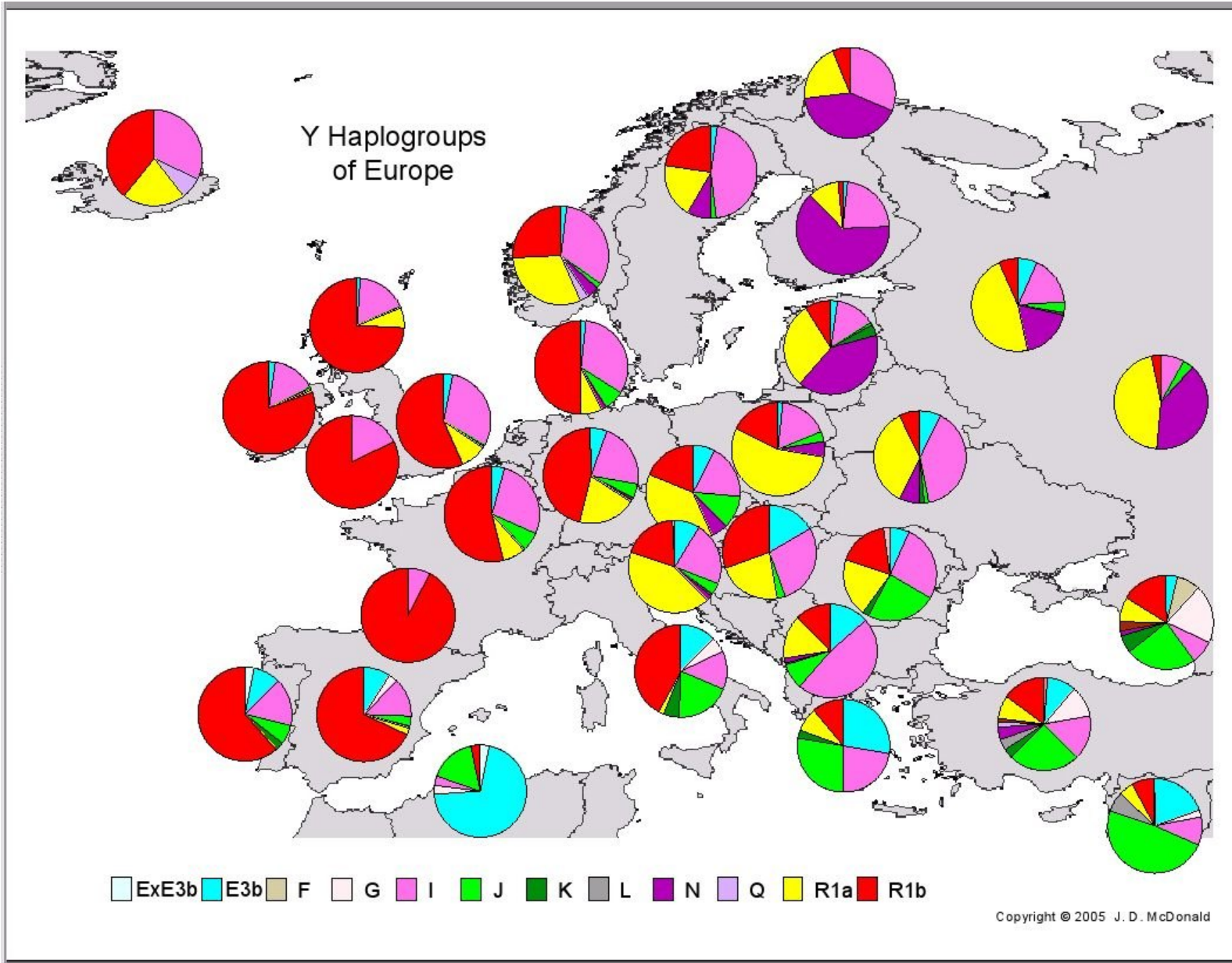


AA Australian Aborigines	IB Iberia	NW Norwegian
AL Altaians	IC Iceland	PE Persian (Iran)
AM Amerinds	IJ Irian Jaya	PG Papua New Guinea
AP Apache (N-D)	IN Indo-European Highlands	PH Philippines
BF Burkina Faso	IT Italy	PY Pygmy
BO Borneo	JP Japan	RU Russia
BU Buryats	KG Kyrgyzstan	SA Saami
CN Cameroon	KT Kazan Tatar	SC Scotland
CW Chippeway (N-D)	KY Koryaks	SL Selkups
CY Cheyenne	KZ Kazakhstan	SF South Africa
DR Dravidian	MA Mideast Arabs	SN Sudan
ES Eskimos	MC Morocco	SU Sumatra
ET Ethiopia	MI Maori	TB Tibet
EV Evenks	ML Mali	TU Turkish
FP French Polynesia	MO Mongols	UG Uygurs
GE Georgia-Armenia	MY Malaysia	UZ Uzbek
GM Germany	NB New Britain	WS Western Samoa
HA Han Chinese	NE Nenets	YA Yakuts



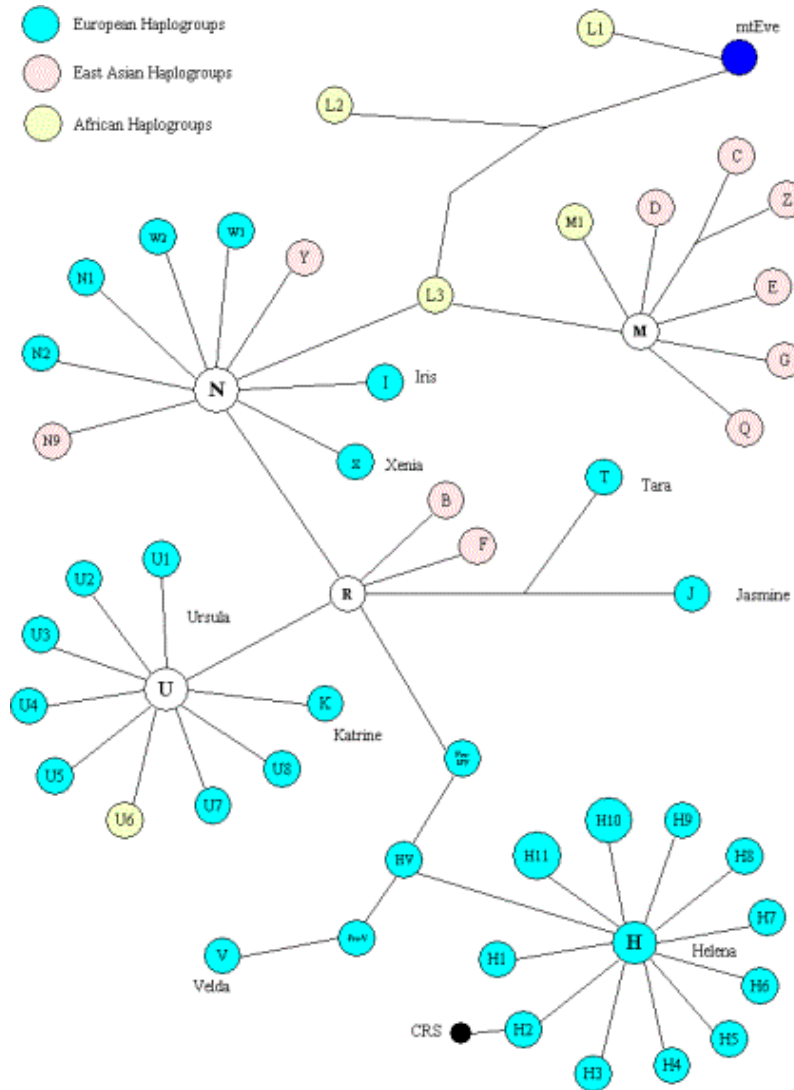
The data in this map is supposed to represent the situation before the recent European expansion beginning about 1500 AD. In some cases such as some Native American tribes and the Maori this can be done reliably because STR typing was done. In other cases, especially in America, it is guesswork. The 'Other' sectors in America indicate this. Native American groups are labeled by language group as Amerind, Na-Dene (N-D), and Eskimo. F, K, L, and P are in some cases "catchall" groups because some researchers did not use enough markers for a full haplotype determination.

# Y-Chromosome Map, Europe

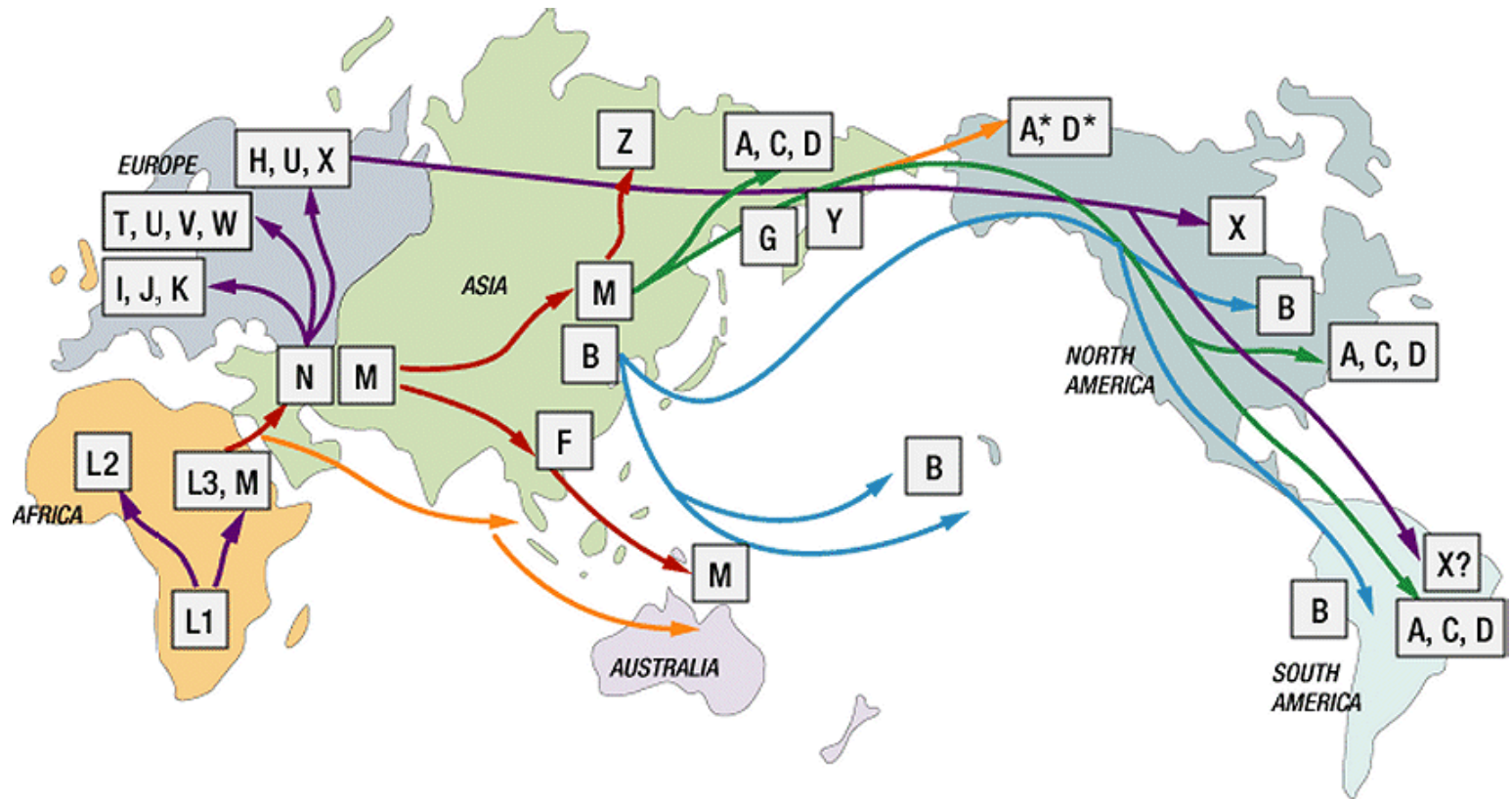




# mtDNA Haplogroups



# mtDNA Migration Map



## EXPANSION TIMES (years ago)

Africa	120,000 - 150,000
Out of Africa	55,000 - 75,000
Asia	40,000 - 70,000
Australia/PNG	40,000 - 60,000
Europe	35,000 - 50,000
Americas	15,000 - 35,000
Na-Dene/Esk/Aleuts	8,000 - 10,000

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# The Genographic Project

- <https://www3.nationalgeographic.com/genographic/index.html>