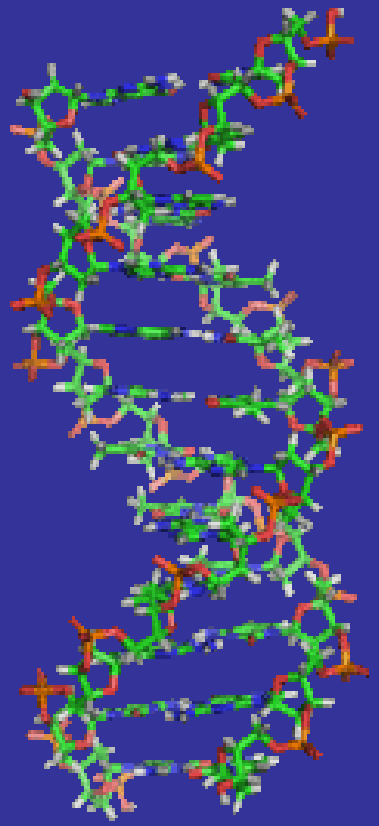
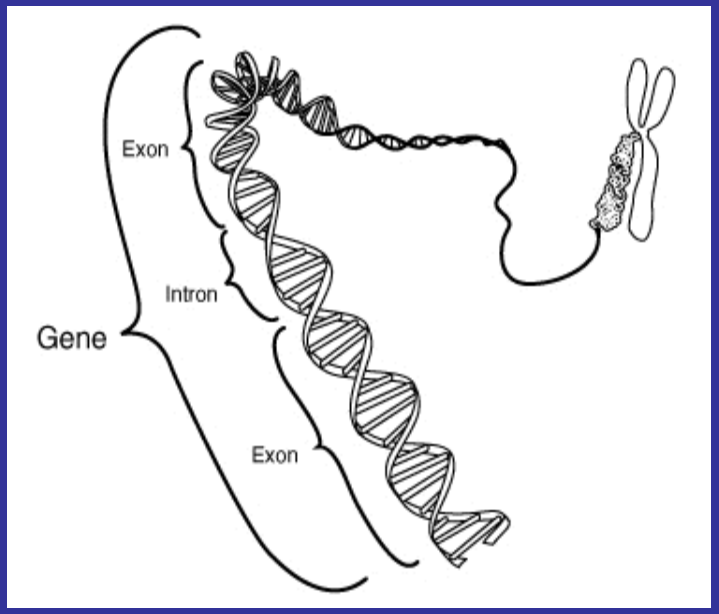
Jewish Genealogy

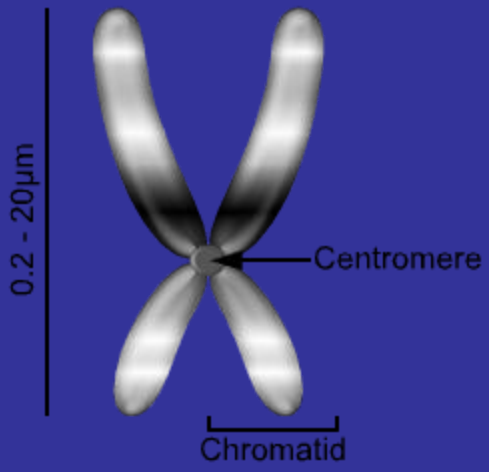
Genes are destiny!

Organization of Genes

- DNA ⟶ Genes ⟶ Chromosomes

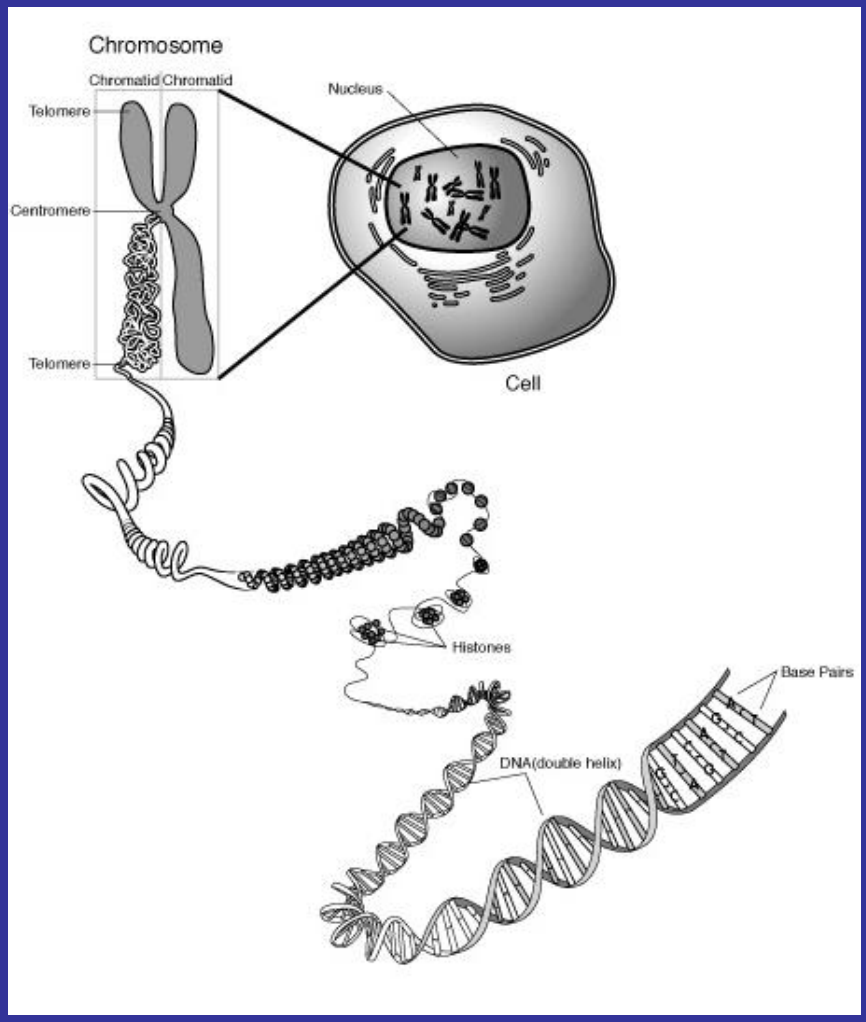






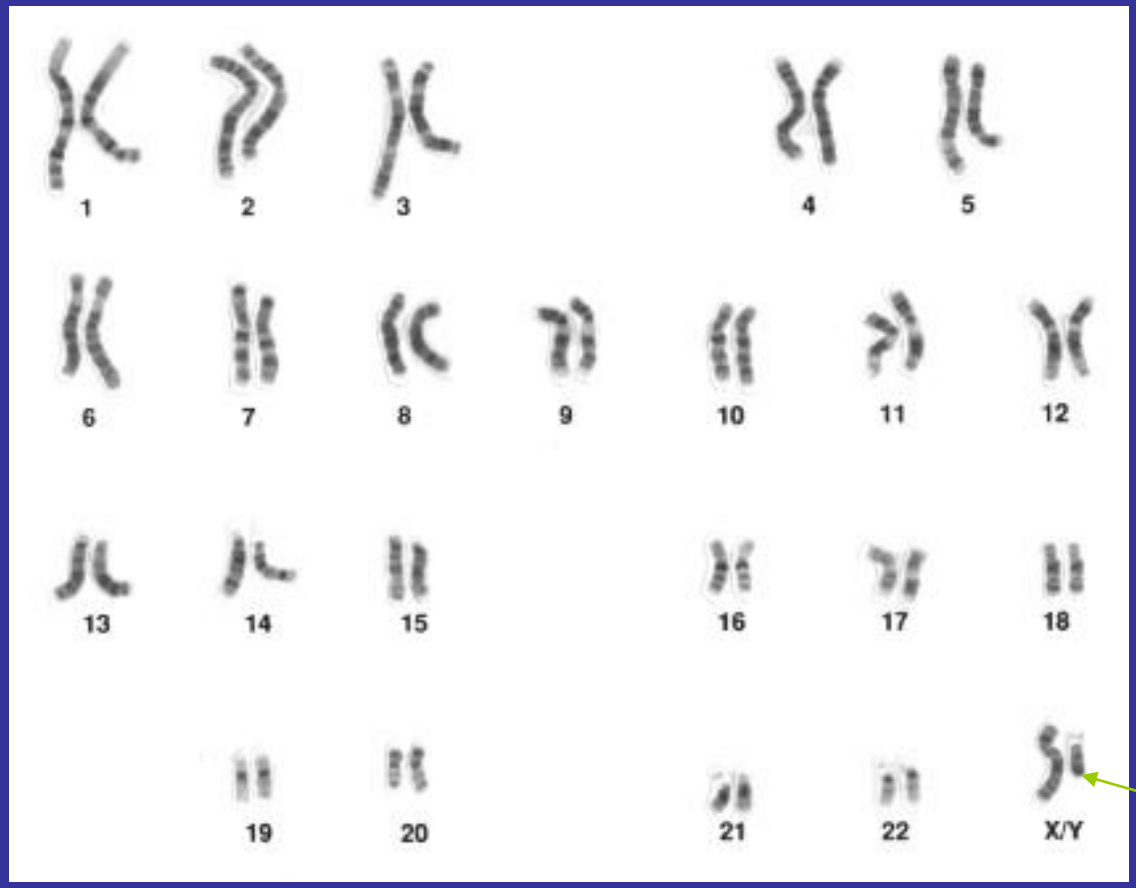
Cell nuclei contain genes

- All cells in an organism contain the same DNA and genes, but different genes are expressed in different cells
- All the genes in an organism are its genotype
- The physical traits caused by genes are the phenotype



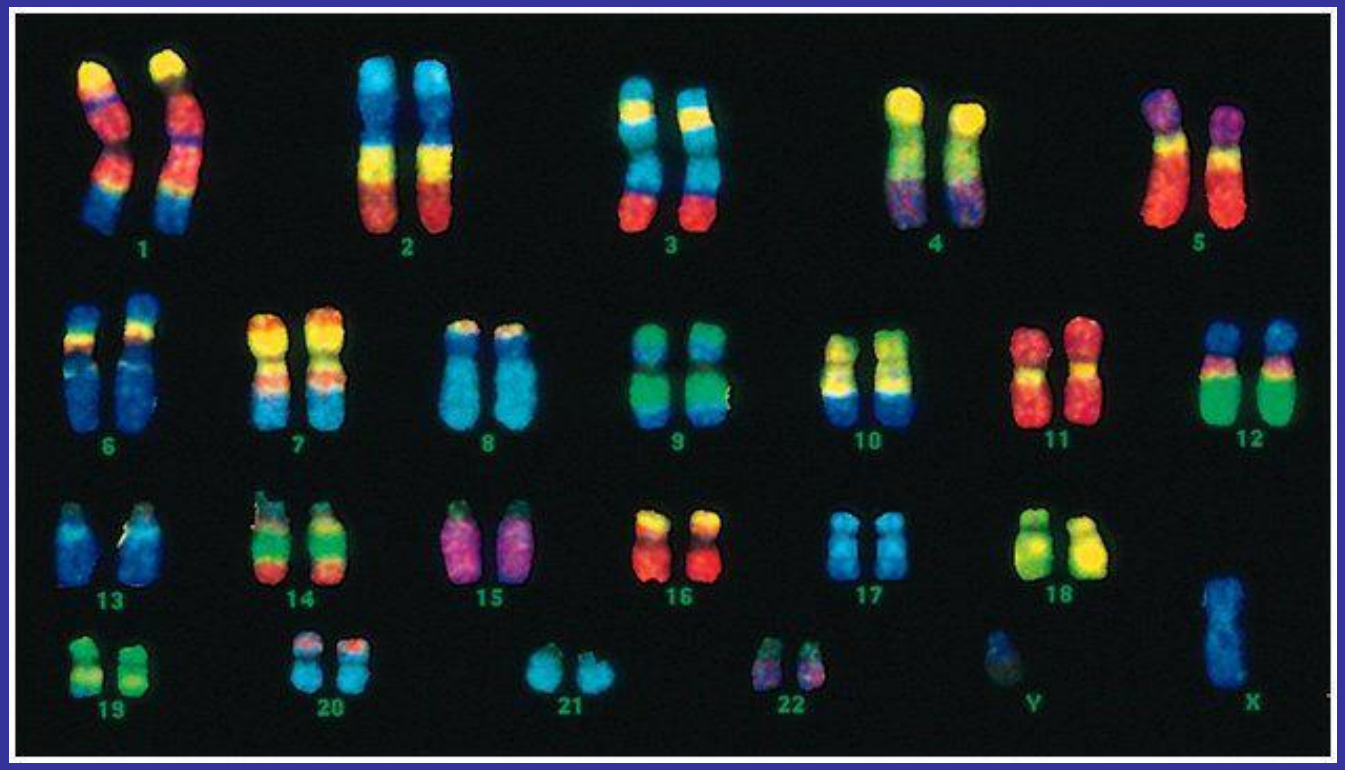
Human Chromosomes

- Karyotyping of human male chromosomes



There are 30,000 genes in the human genome

Fluorescent *In-Situ* Hybridization (FISH) identification of Human Chromosomes - *"Chromosome Painting"*



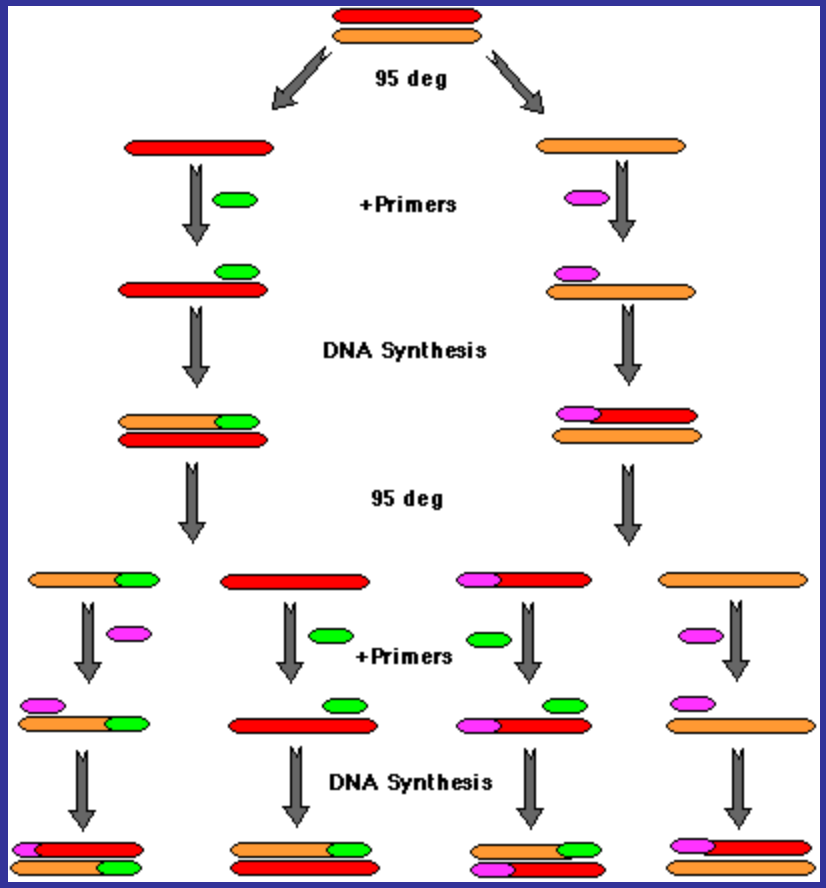
DNA probes specific to regions of particular chromosomes are attached to fluorescent markers and hybridized with a chromosome spread. The picture shows a computer-generated *"false colour"* image in which small variations in fluorescence wavelength among probes are enhanced as distinct primary colours. The combination of probes that hybridize to a particular chromosome produces a unique pattern for each chromosome.

Methods of DNA analysis I

For multiplication of DNA sample use PCR (polymerase chain reaction)

1. Denaturation (95$^{o)}$
2. Add primer
3. DNA synthesis
4. Repeat process as many times as required

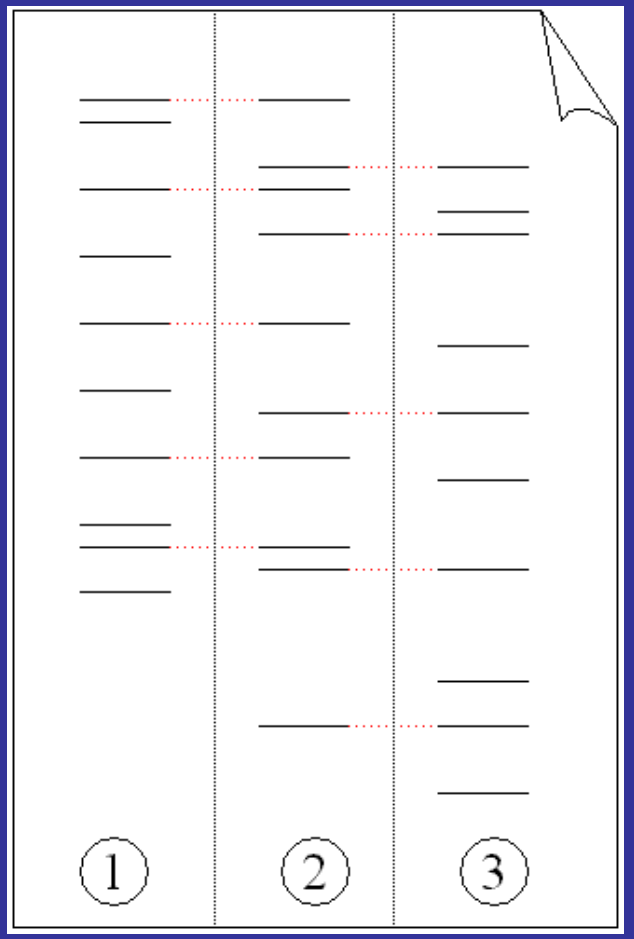
PCR



Methods of DNA analysis II

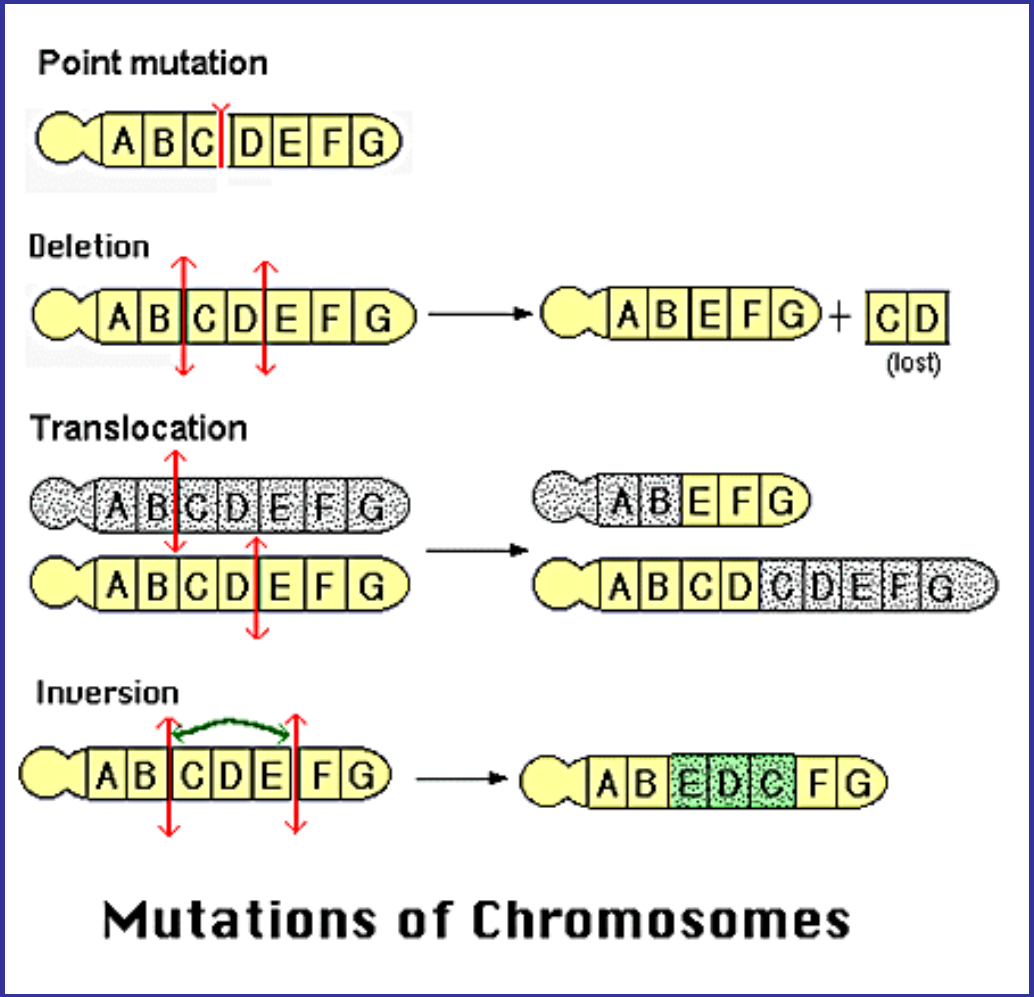
1. Add restriction endonucleases to cleave DNA specifically
2. For identification of DNA use bands in gel electrophoresis to separate RFLPs (restriction fragment length polymorphisms)
3. From pattern of bands (fragments) identify relationships (e.g. 1, father; 2 son; 3 mother)

Gel electrophoresis



Mutation of Chromosomes

Mutations arise from base alterations in DNA or chromosomal translocations



Genealogy

- The genetic relationships between individuals and/or groups
- To establish genetic relationships use genetic markers (e.g. RFLPs)
- Use genetic disease as markers
- These derive form mutations that are passed on from one generation to the next

Jewish genetic diseases

- Tay-Sachs disease
- Familial Mediterranean fever (FMF)
- Fanconi anemia
- Gaucher disease
- Neiman-Pick disease
- Breast cancer (BRCA1)
- Bloom’s disease
- Canavan’s disease

Genetic markers

- For matrilineal inheritance – use mitochondrial (mt) DNA found in the mitochondria of the cell, and passed on only from the egg (ovum)
- For patrilineal inheritance – use Y-chromosome, found only in males (XY) and not females (XX)

Cohen genetic marker

- Cohanim are both matrilineal (Jewish) and patrilineal (Cohen)
- Cohen carefully preserved inheritance (selective breeding)
- Genetic markers (7) in Y-chromosomes define (Cohen modal haploid, CMH) found in 90% of several hundred Cohanim, not in other Jews (work of Dr. Skorecki HU).

Genetic typing

- Genetic markers can show linkage between animal species to establish evolutionary trees
- Comparison of markers for human racial groups indicate Jews are more similar to Kurds than to Arabs

Family genealogy

- For family relationships (family trees), there are now many web sites in Eastern Europe
- There are also sites connected to the Holocaust
- For example, in Bad Arolson, Germany, there is the “International Tracing Center” that has records on over 50 million people.

Conclusions

- There are no specifically Jewish genes
- There are genetic markers for Cohanim and possibly Levites
- Some genetic diseases are preferentially Jewish
- Further research may lead to Jewish genetic markers, although given the extent of intermixing this is unlikely