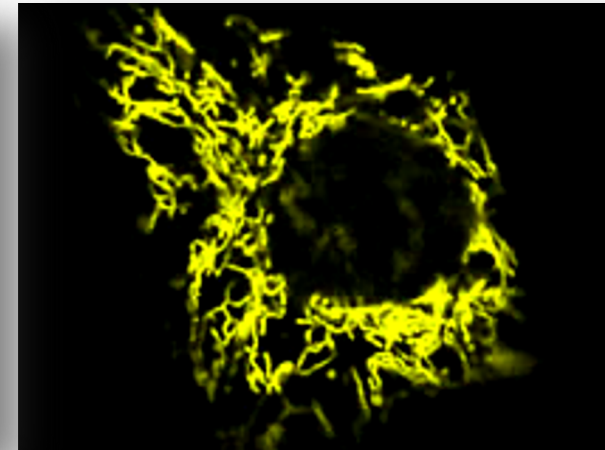
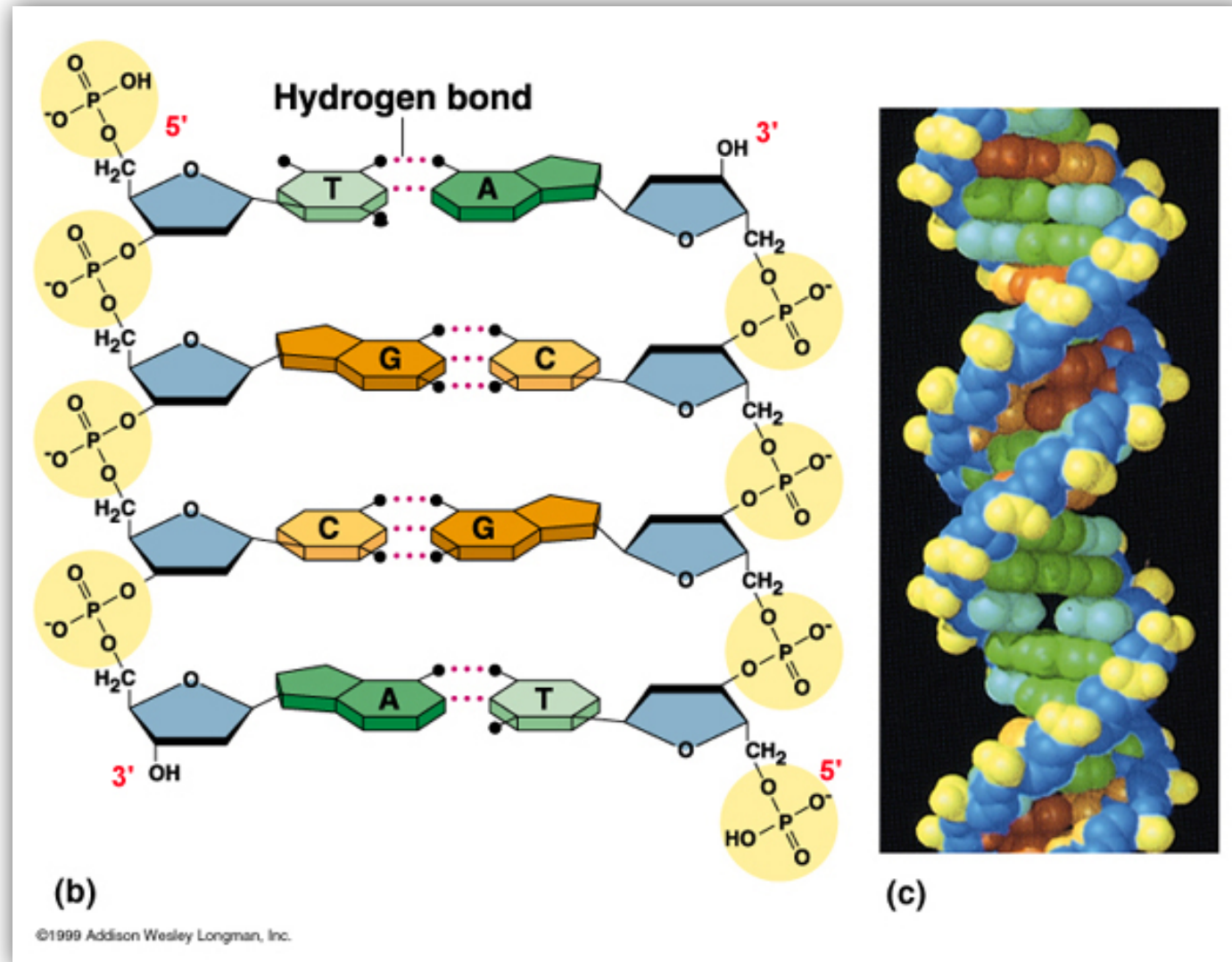


Mitochondrial DNA Basics

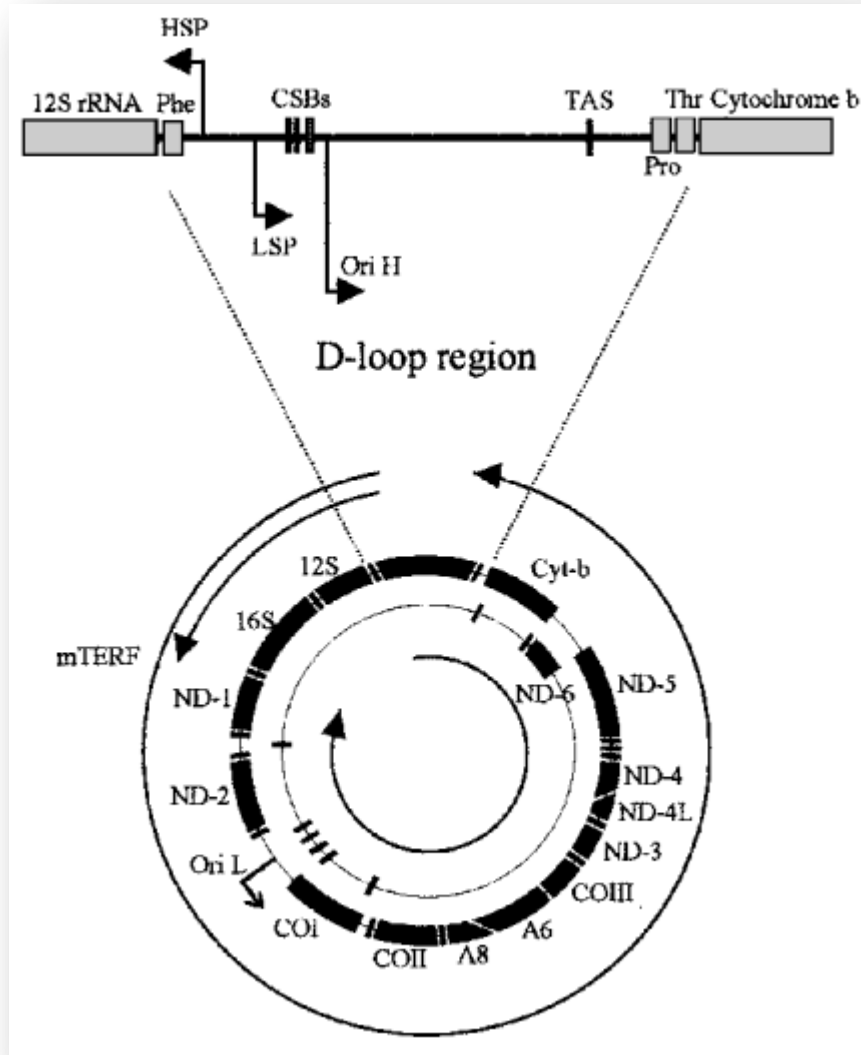
Mitochondria – the powerhouse of the cell



Mitochondrial DNA is DNA



Mitochondrial DNA Structure



Human Mitochondrial DNA
16569 bp



Endosymbiont Theory

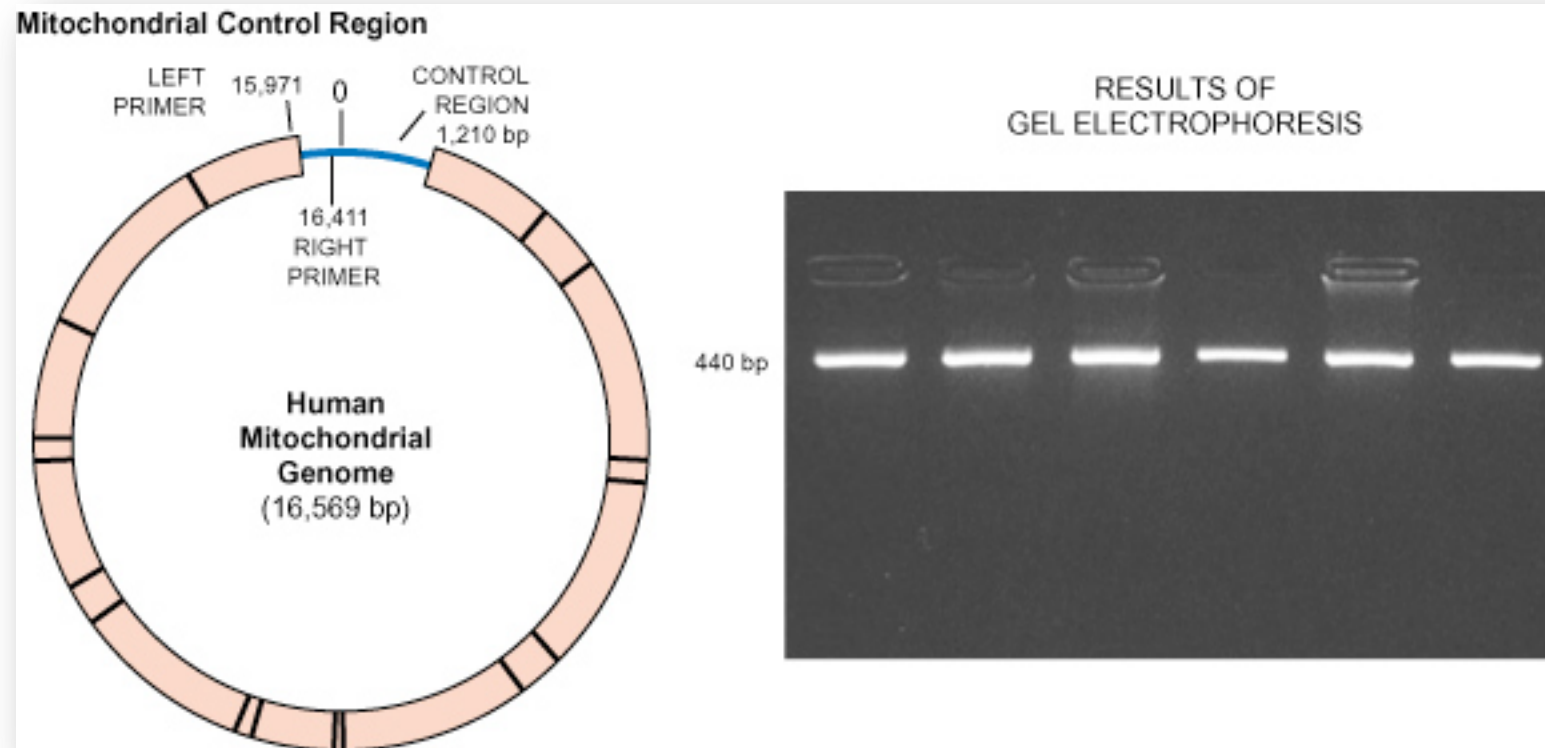


Константин Мережковский

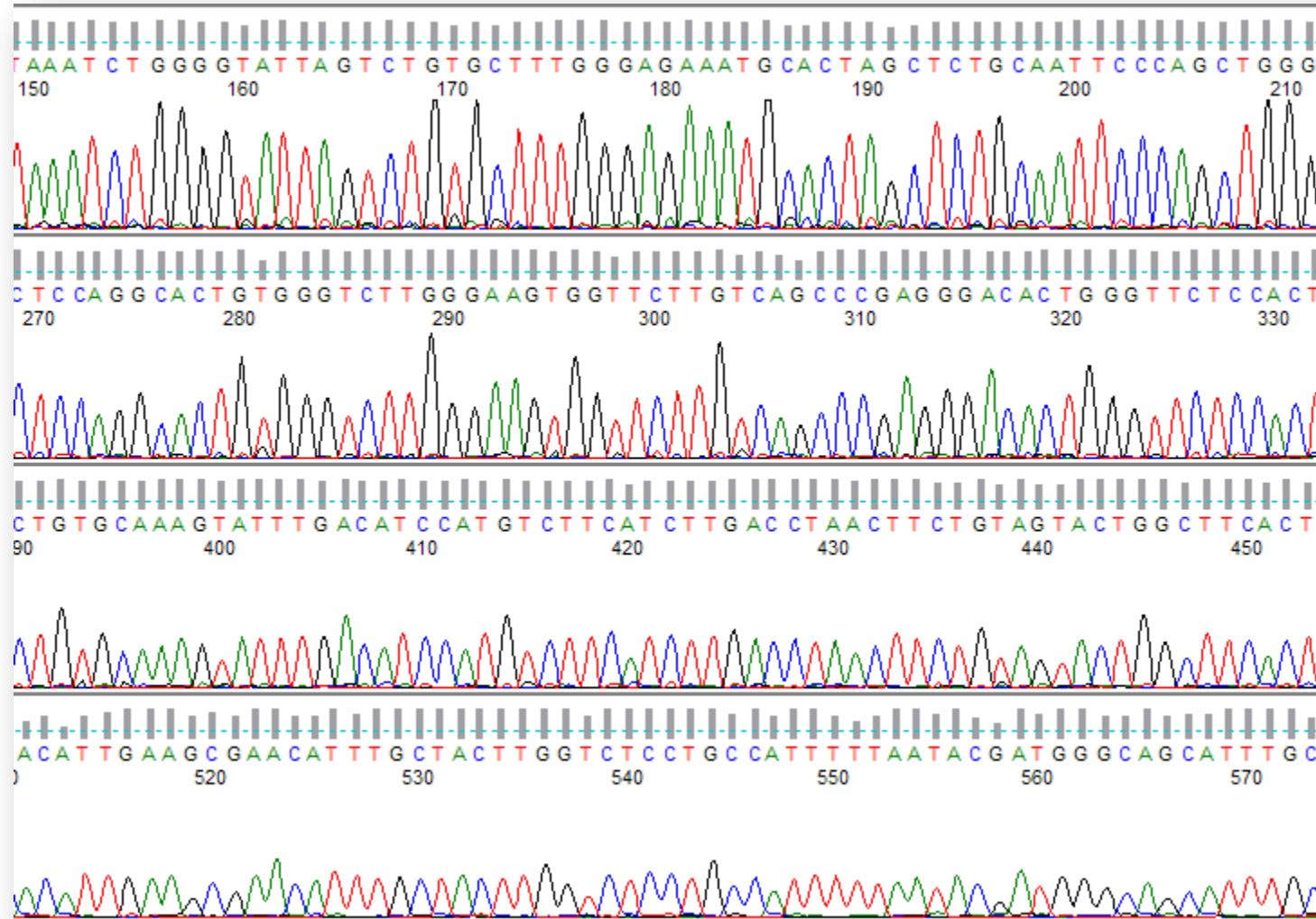


Lynn Margulis

Mitochondrial DNA – replicated by PCR



DNA Sequencing

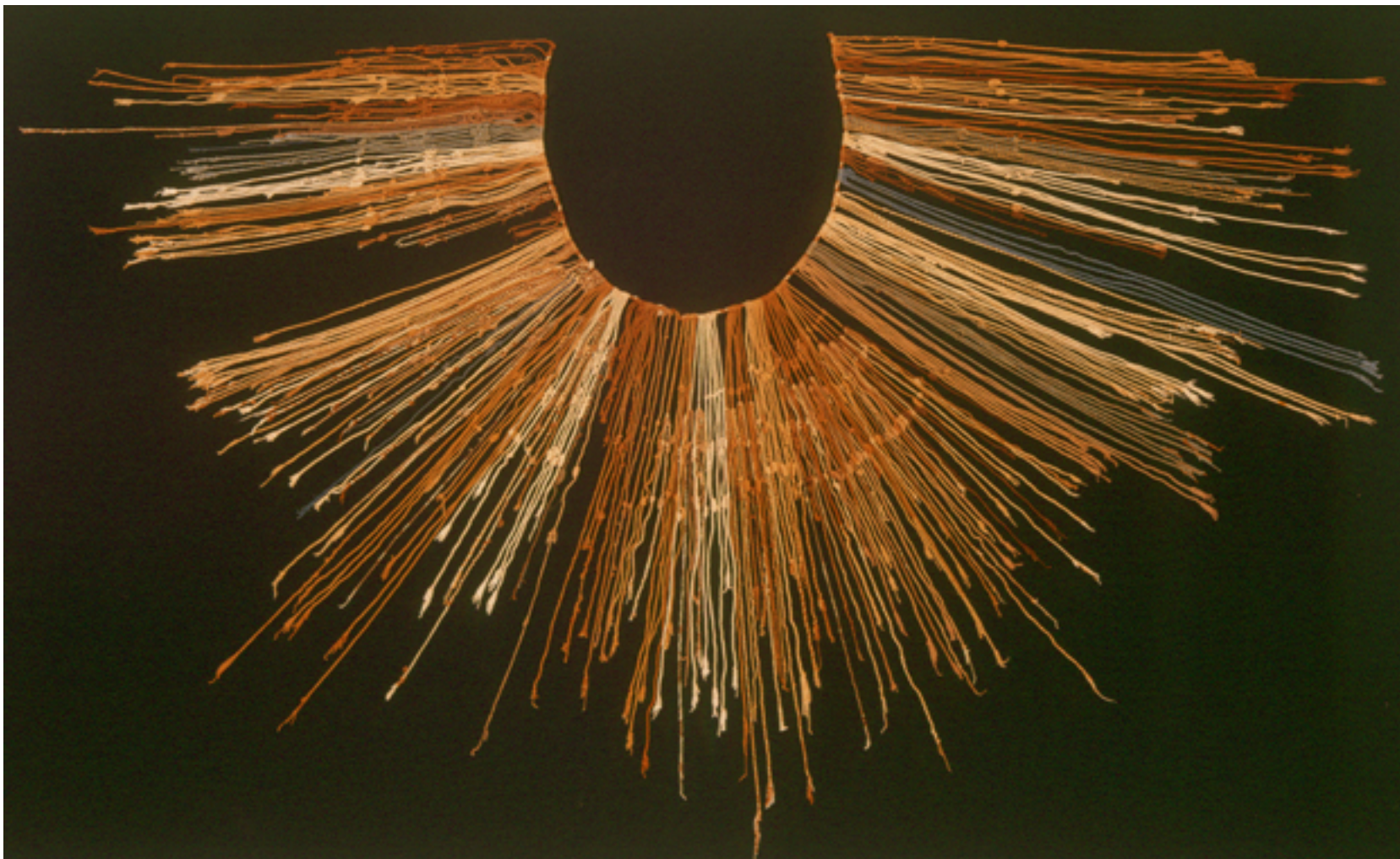


Mitochondrial genes

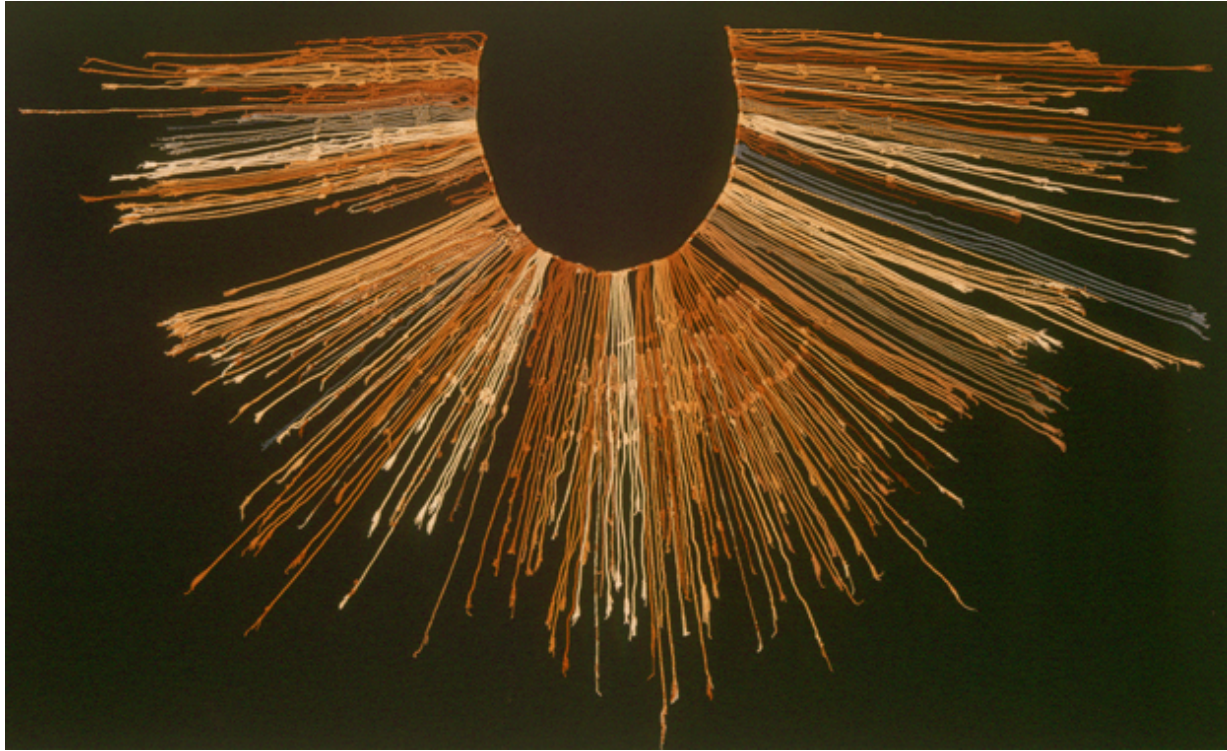
Gene Basics

Molecular biology Introduction

What is this?



Quipu



A quipu usually consisted of cotton or camelid fiber strings. The Inca people used them for collecting data and keeping records, monitoring tax obligations, properly collecting census records, calendrical information, and for military organization. The cords stored numeric and other values encoded as knots, often in a base ten positional system.

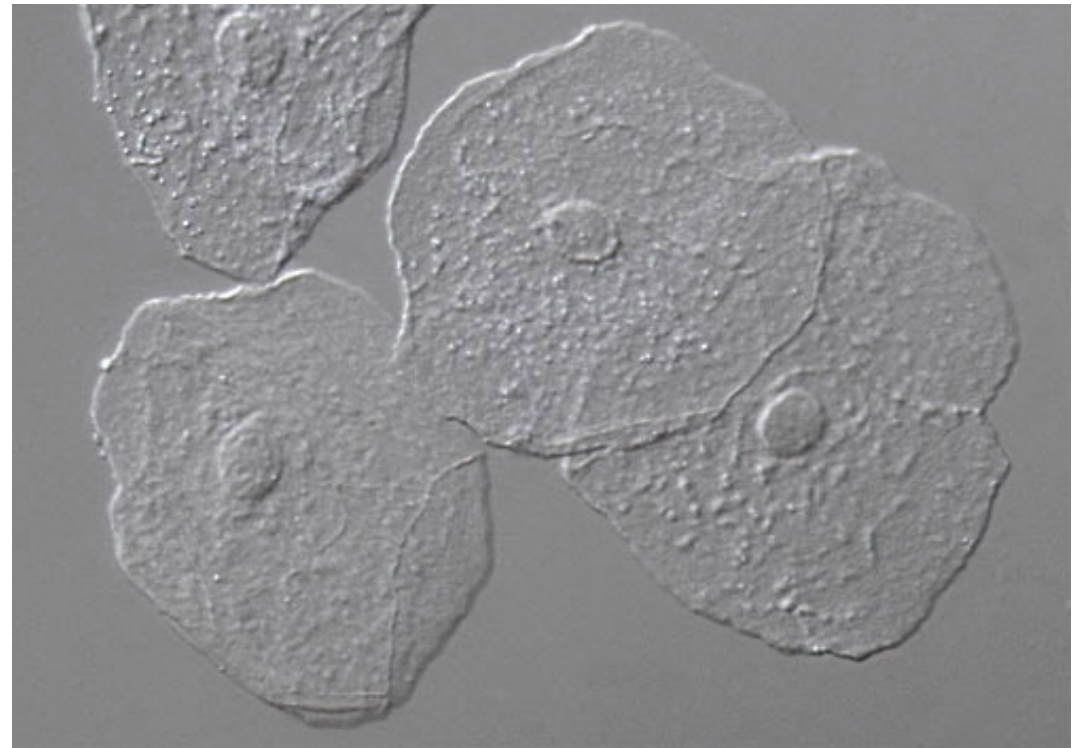
– en.wikipedia.org/wiki/quipu

DNA – Nucleus



https://www.geneticcentre.org/FACILITIES_CYTOGENETICS.html

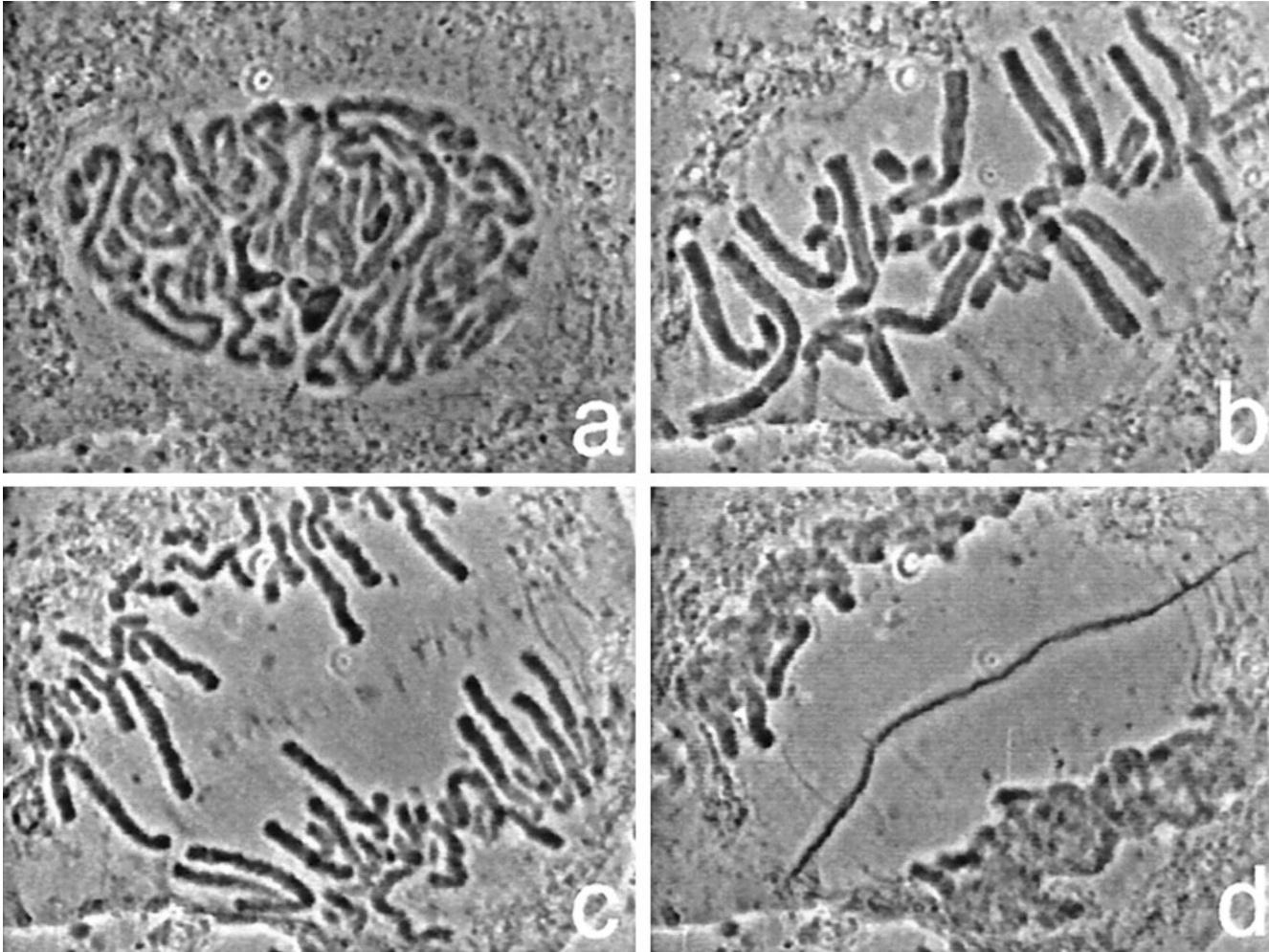
Human metaphase chromosomes



https://www.microscopyu.com/assets/gallery-images/Comparison/DIC_cheekcellsdic.jpg

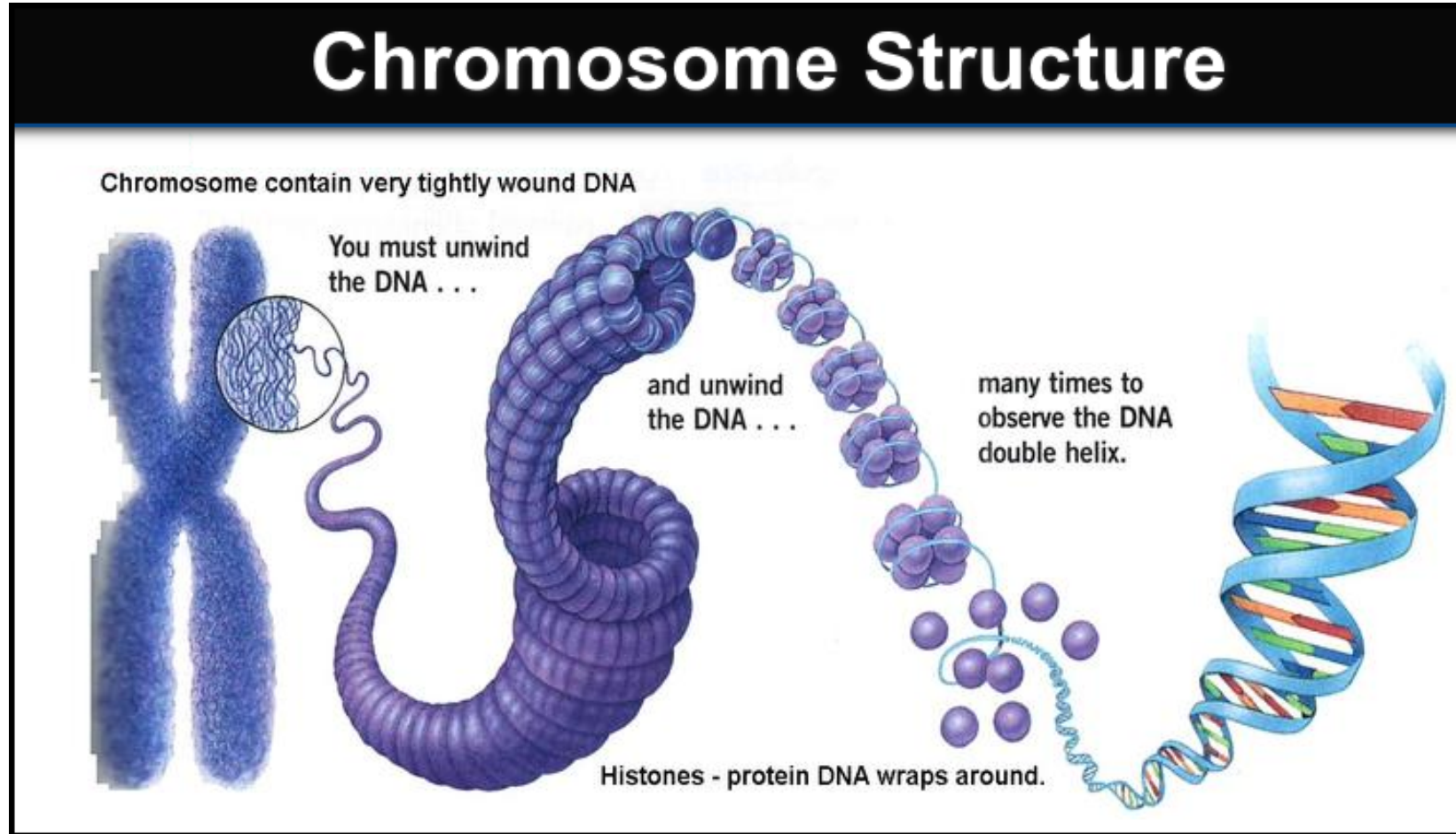
Human cheek cells

DNA - Chromosomes

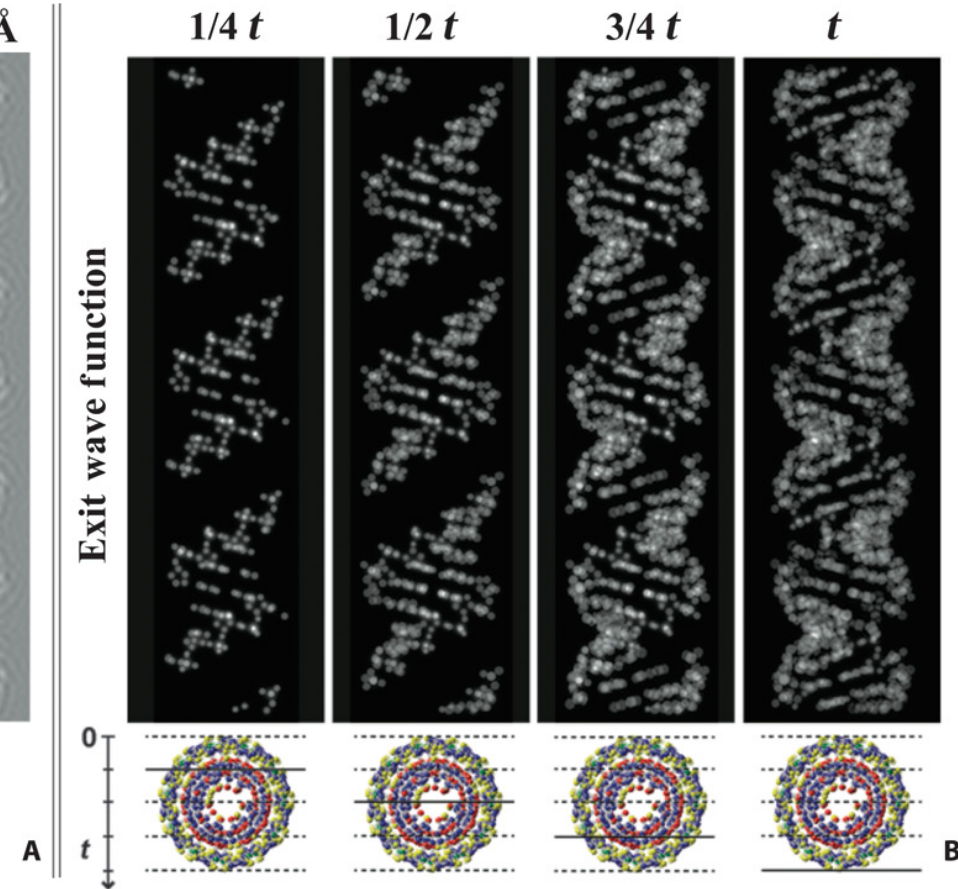
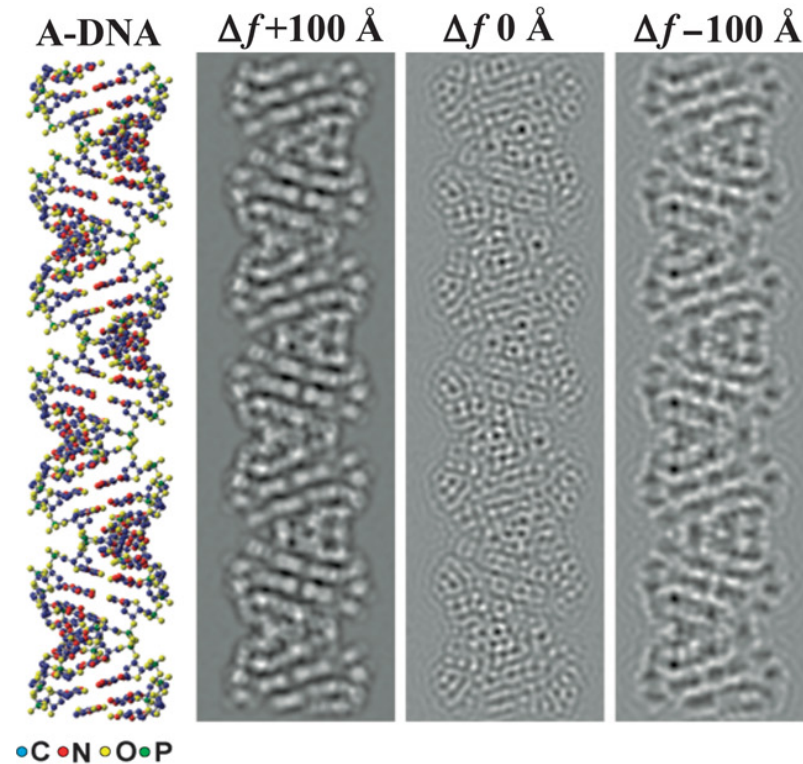
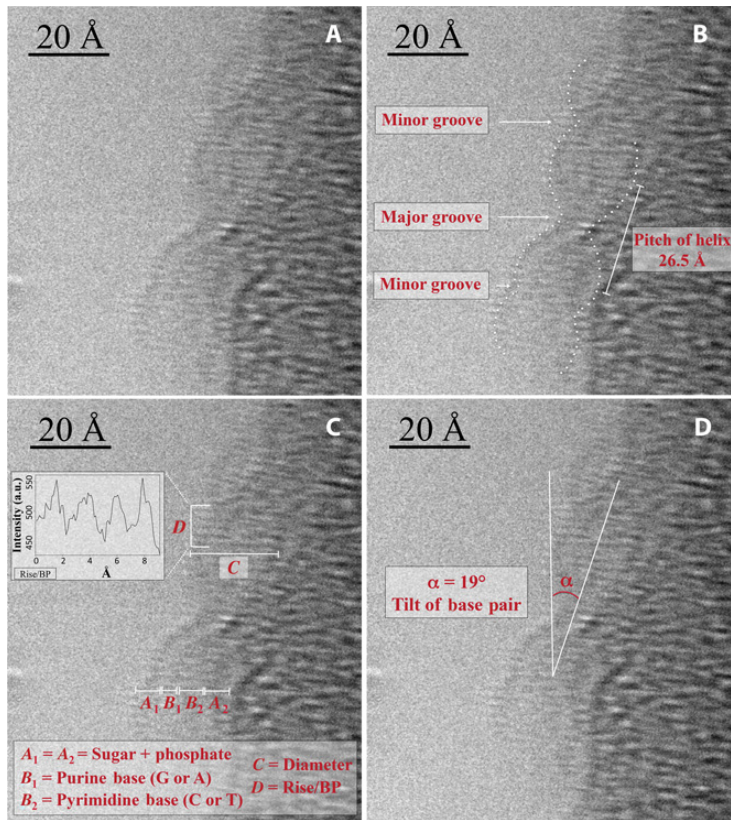


Mitosis and cell plate formation in a flattened endosperm cell of the African blood lily, *Haemanthus katherinae*, observed with phase contrast microscopy. (a) prophase, (b) metaphase, (c) anaphase, (d) telophase.

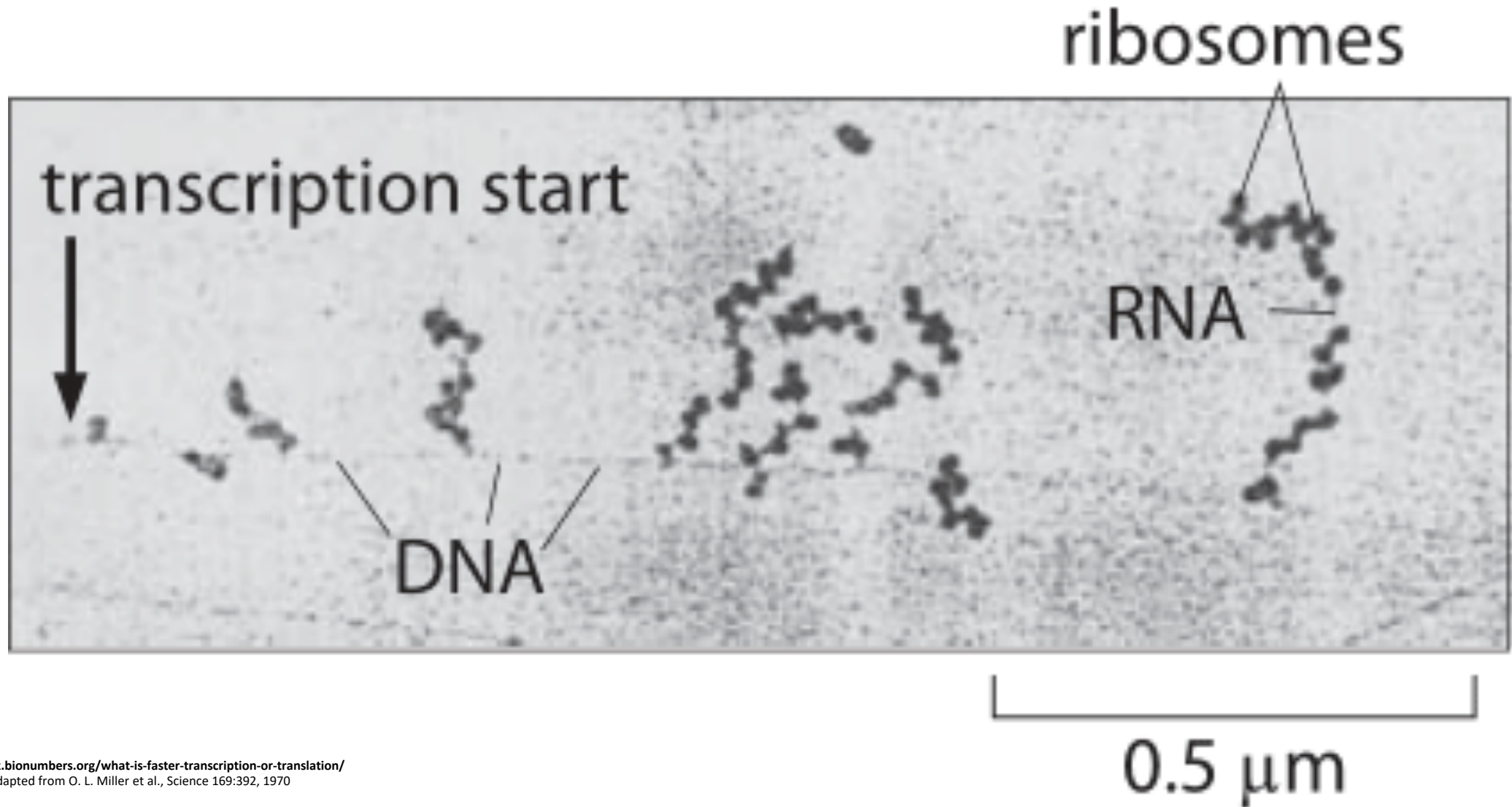
DNA - Structure



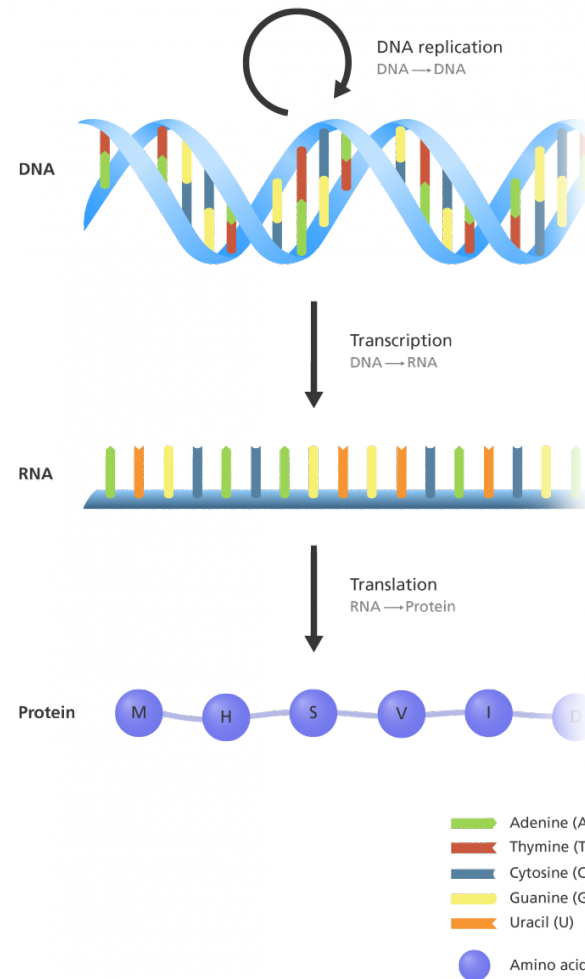
DNA – Electron microscopy



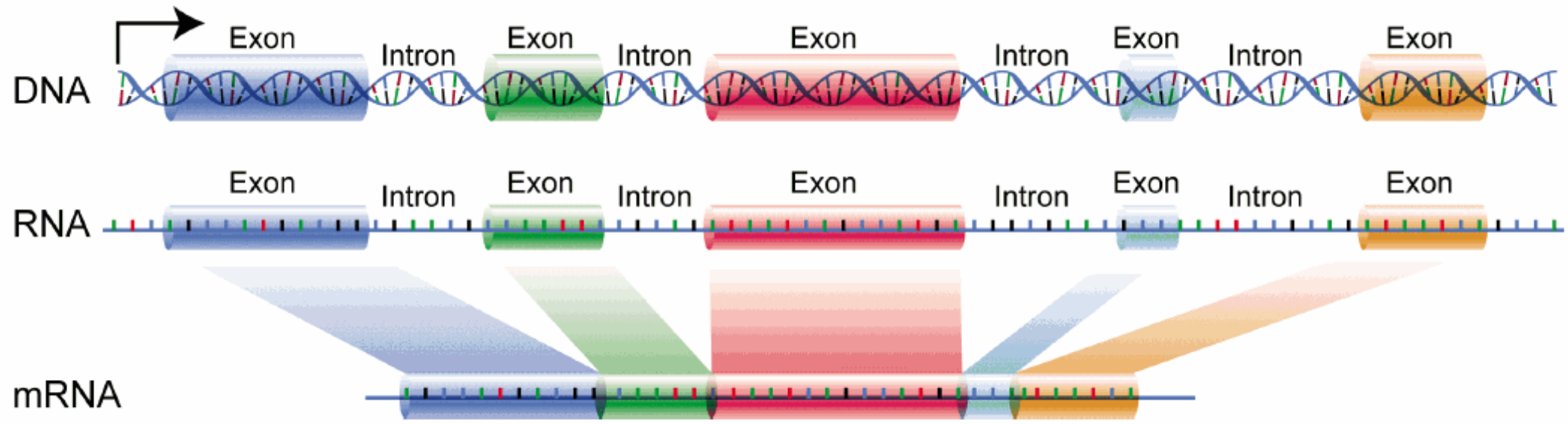
DNA – Electron microscopy



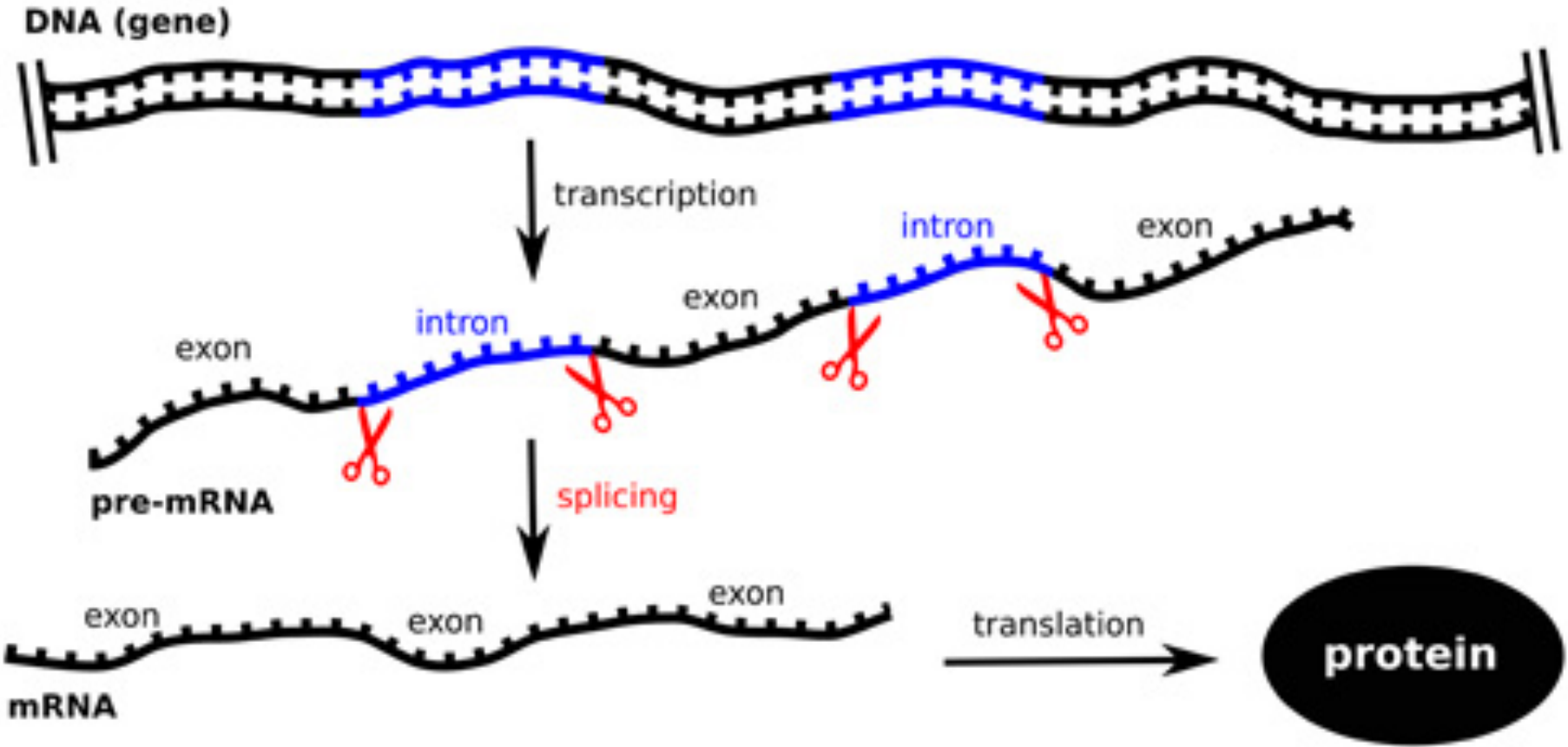
Genes contain useful information



Gene Structure

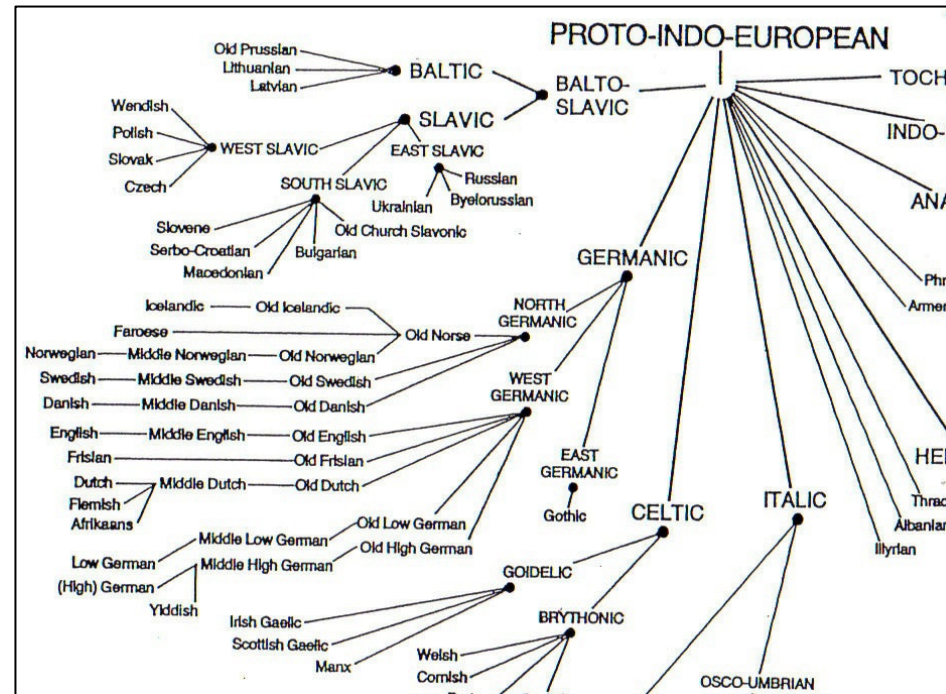


DNA Splicing



One way to find information is to make
comparisons

Words can be conserved



| English | Dutch | German | Danish | Norwegian | Swedish | Icelandic |
|-----------|---------|---------|--------|-----------|---------|-----------|
| book (n) | boek | buch | bog | bok | bok | bók |
| come (v) | komen | kommen | komme | komme | komma | koma |
| drink (v) | drinken | trinken | drikke | drikke | dricka | drekka |

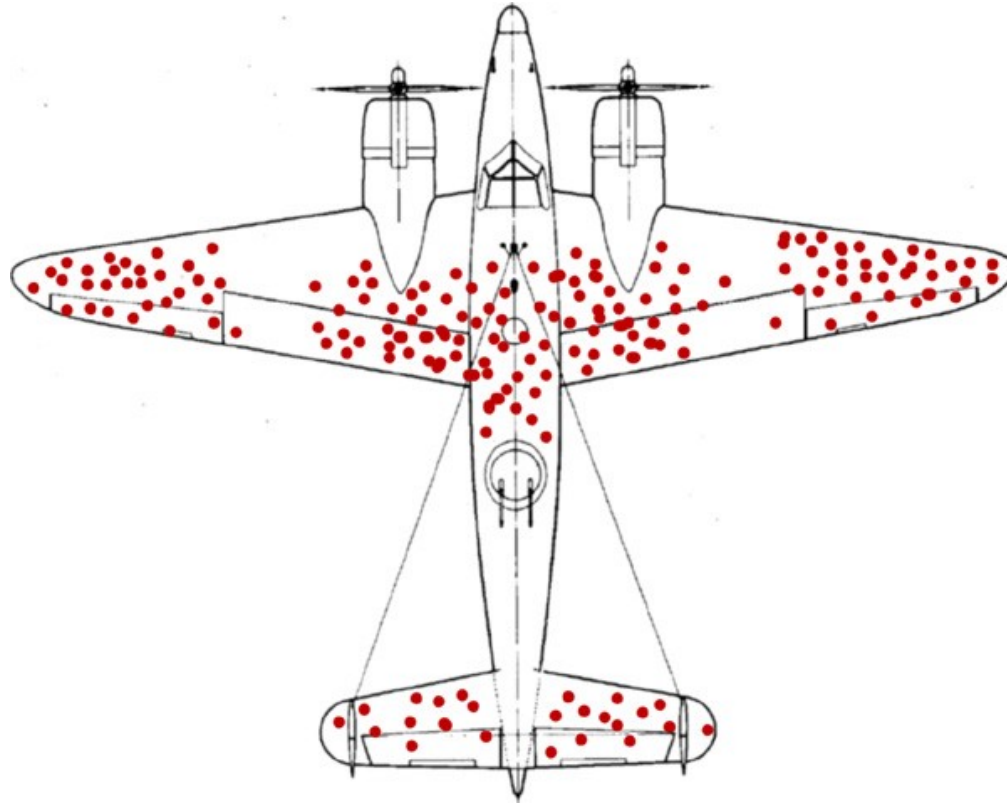
What can you change?

Ingredients

- 1 cup white sugar
- 1 1/2 cups all-purpose flour
- 1/2 cup butter
- 1 3/4 teaspoons baking powder
- 2 eggs
- 1/2 cup milk
- 2 teaspoons vanilla extract
- Add all ingredients to list



Genes with essential functions are heavily conserved



Survivorship bias

We can categorize these changes (mutations)

Transitions

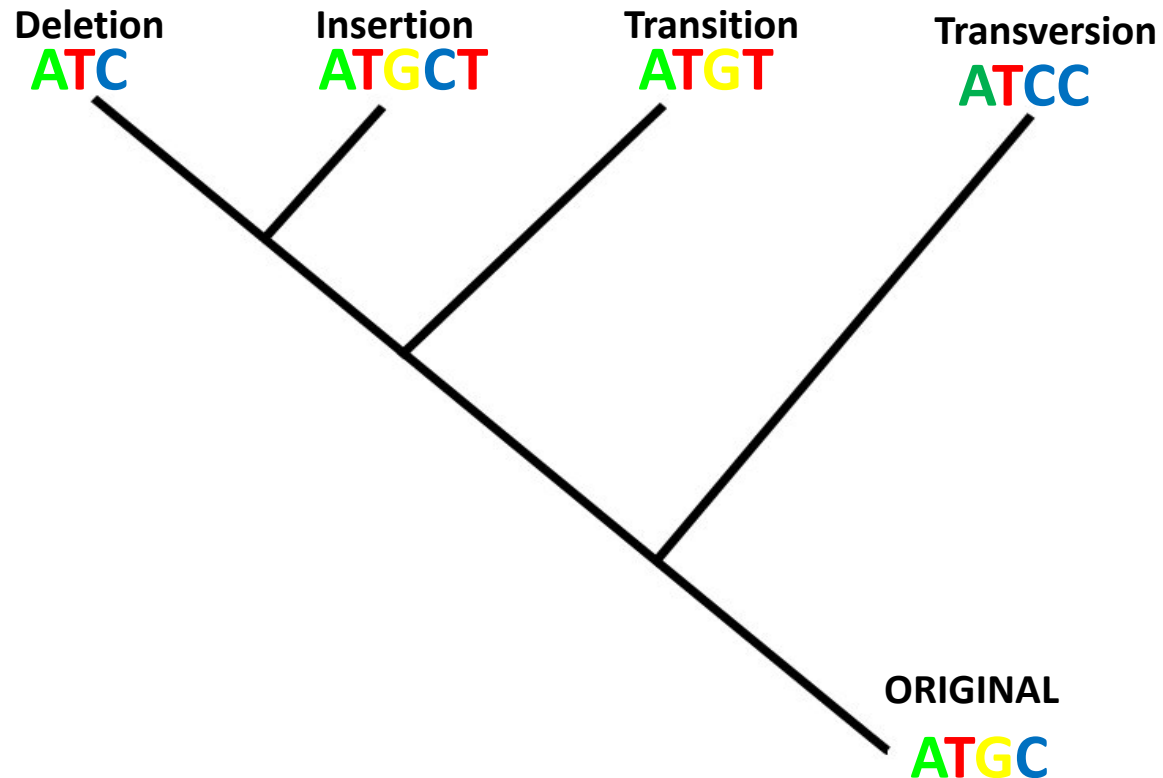
Purines(A/G) mutated to
Purines
Or
Pyrimidines (C/T)
mutated to Pyrimidines

Transversions

Purines (A/G) to
Pyrimidines (C/G) or vice
versa

Indels

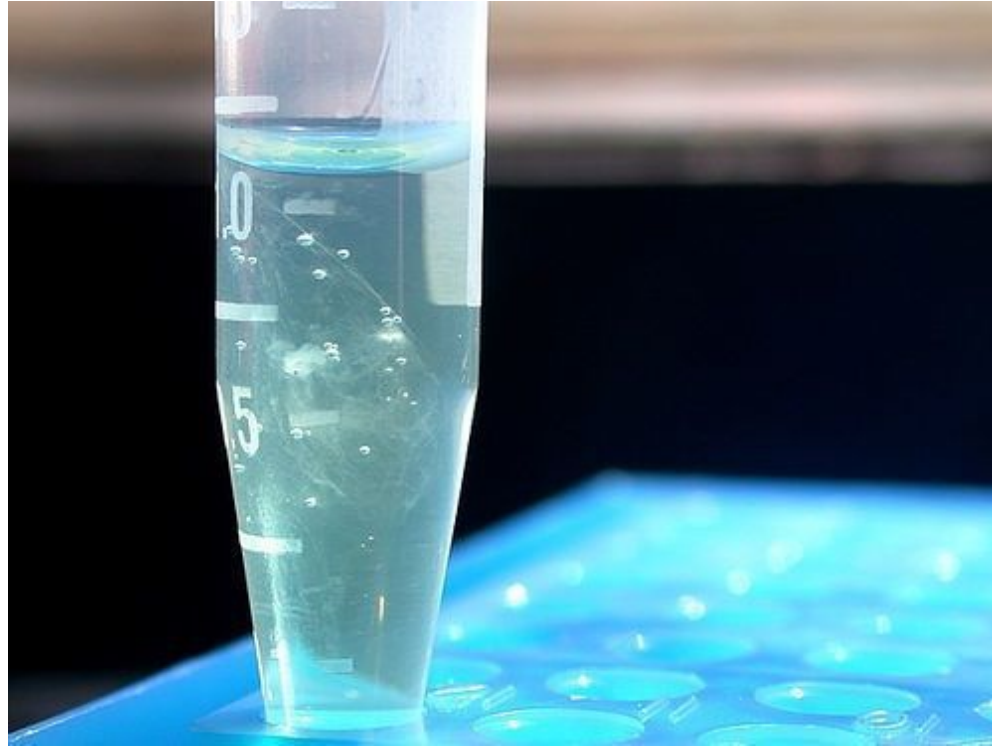
Gain or Loss of
Nucleotides



Summary points

- Mitochondrial DNA contains genes (and non-genes, more on this later)
- On any given stretch of a chromosome, DNA may either contain useful information (gene) or not contain any information
- Genes that are “important” (have a function essential to life) tend to be conserved
- Changes in genes (mutations) can either be insertions/deletions (indels), transitions, or transversions

Review: Mitochondrial lab



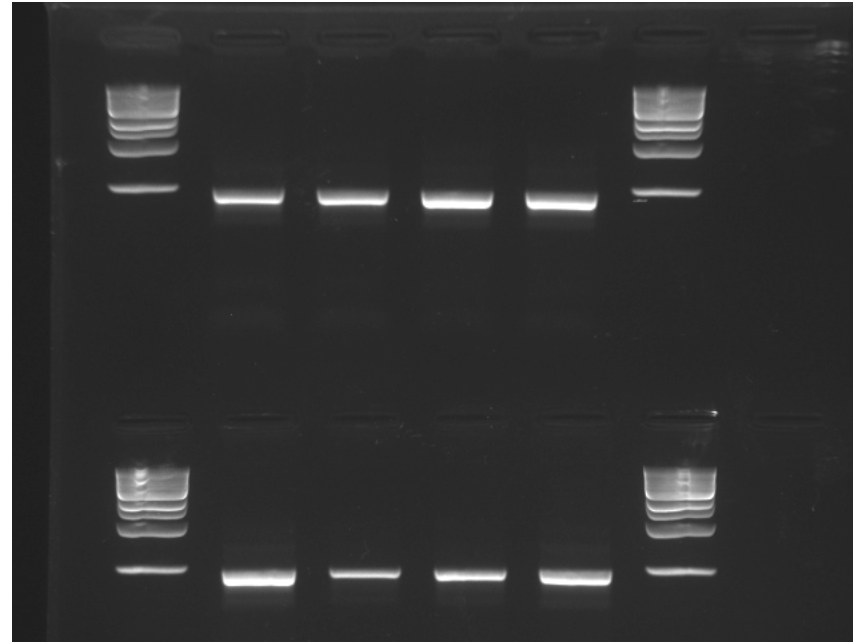
DNA Extraction from buccal cheek cells

Review: Mitochondrial lab



DNA Amplification by PCR

Review: Mitochondrial lab



Electrophoresis

Ladder

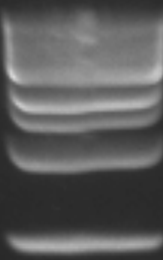
1

2

3

4

Ladder



Ladder

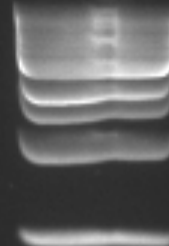
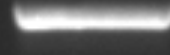
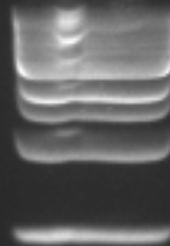
5

6

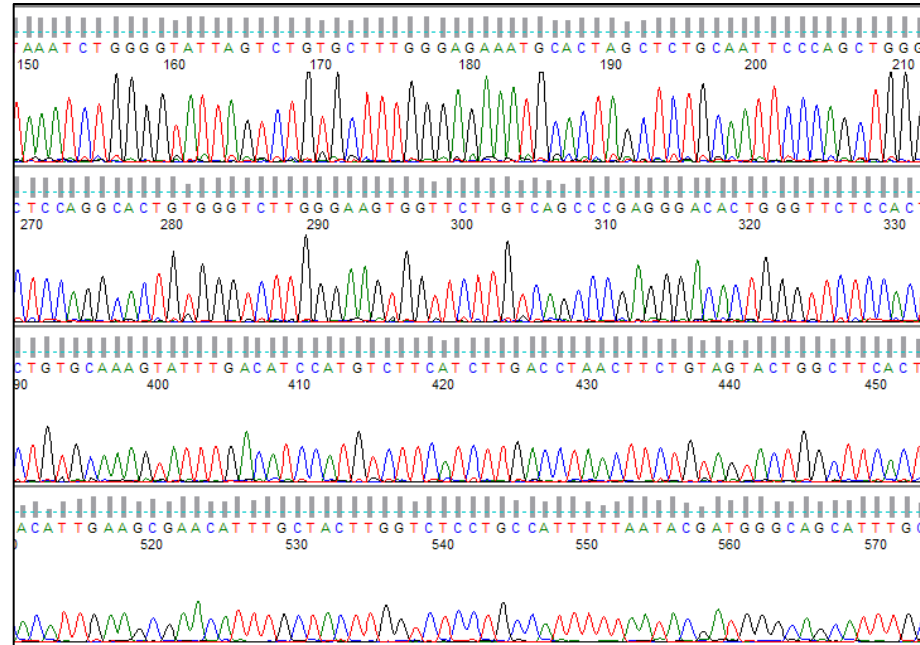
7

8

Ladder



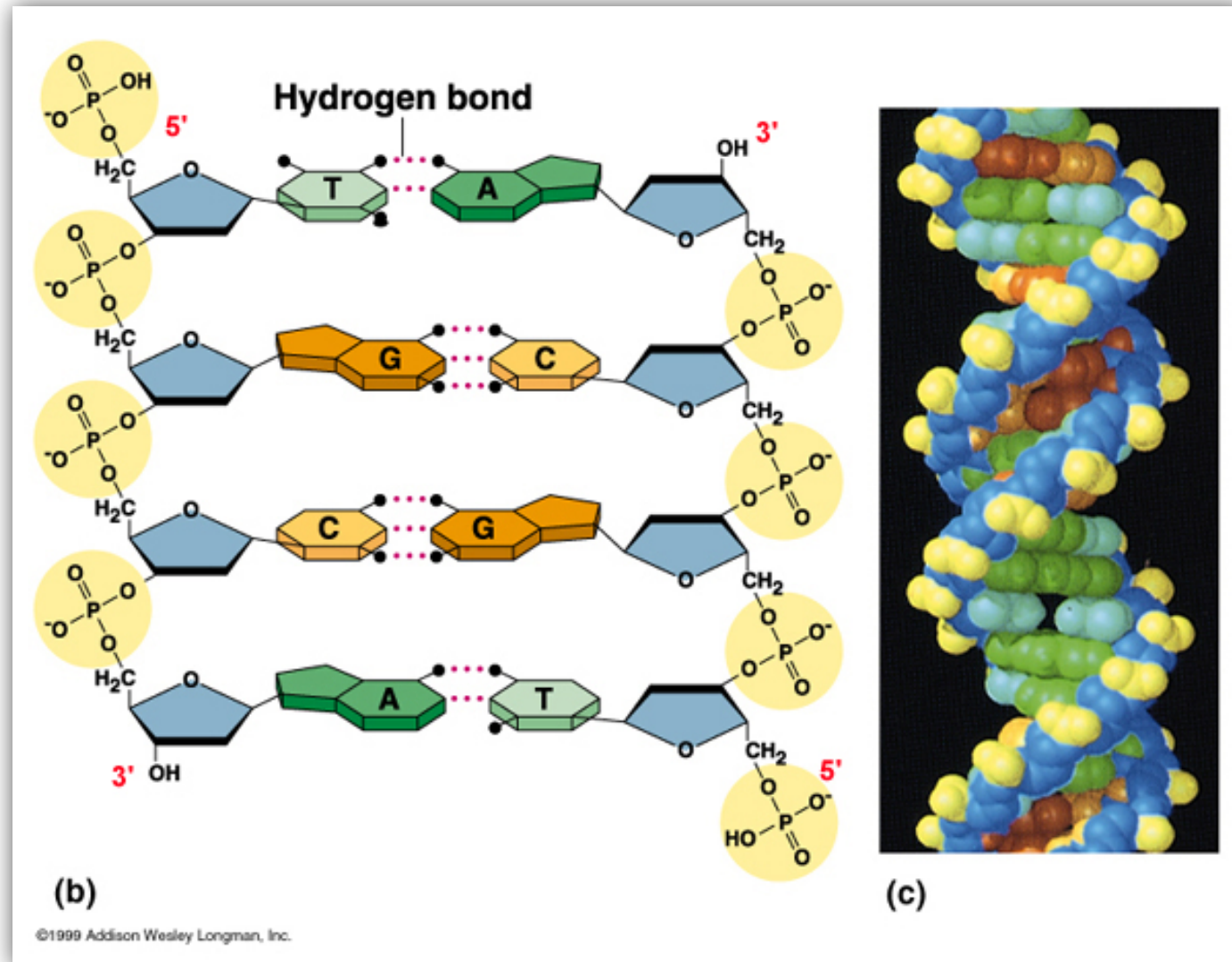
Review: Mitochondrial lab



DNA Sequencing

What is a gene?

What is a gene



What is a word?

习近平：南海诸岛自古以来就是中国领土

中国政府声明 王毅谈话 外交部声明 国防部表态 新华社评论员 真相与谎言 多国领导人支持我立场 专题

更多头条>>

习近平关于南海问题有何重要论述？

最新 今年以来，习近平主席在不同场合阐述中国在南海问题上的原则立场。“讲习所”推出文章，为您梳理解读。

关于所谓南海仲裁 习近平为何说“不”

最新 中菲南海争议的本质是菲律宾非法侵占中国南沙群岛部分岛礁所产生的领土争议。

习近平仲夏之旅实现三大跨越

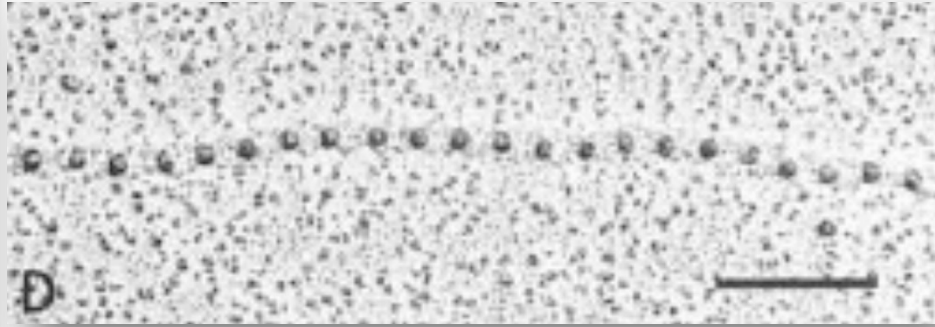
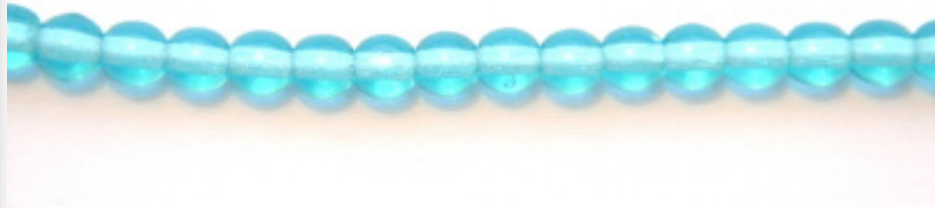
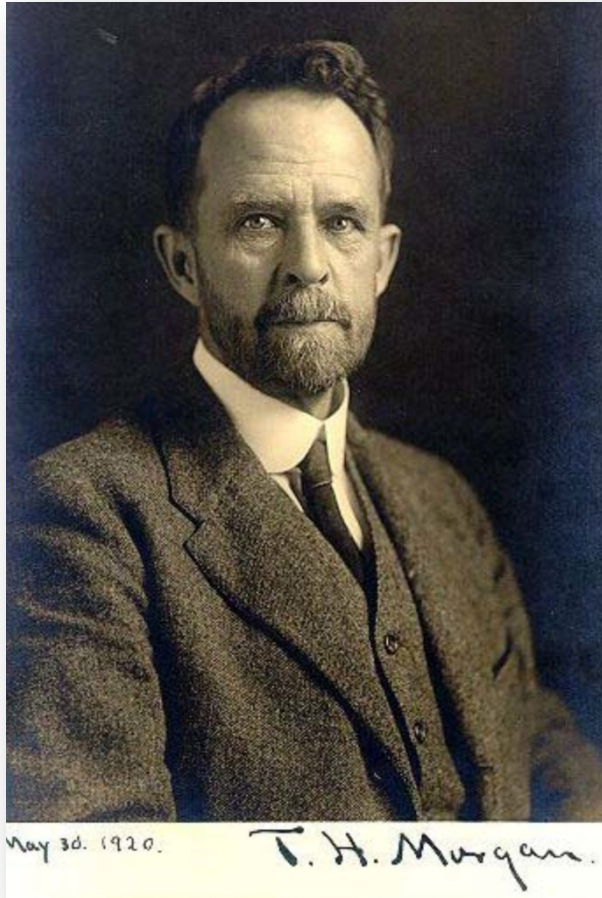
最新 仲夏时节，国家主席习近平应邀对塞、波、乌进行国事访问，并赴塔什干出席上海合作组织成员国元首理事会第十六次会议。



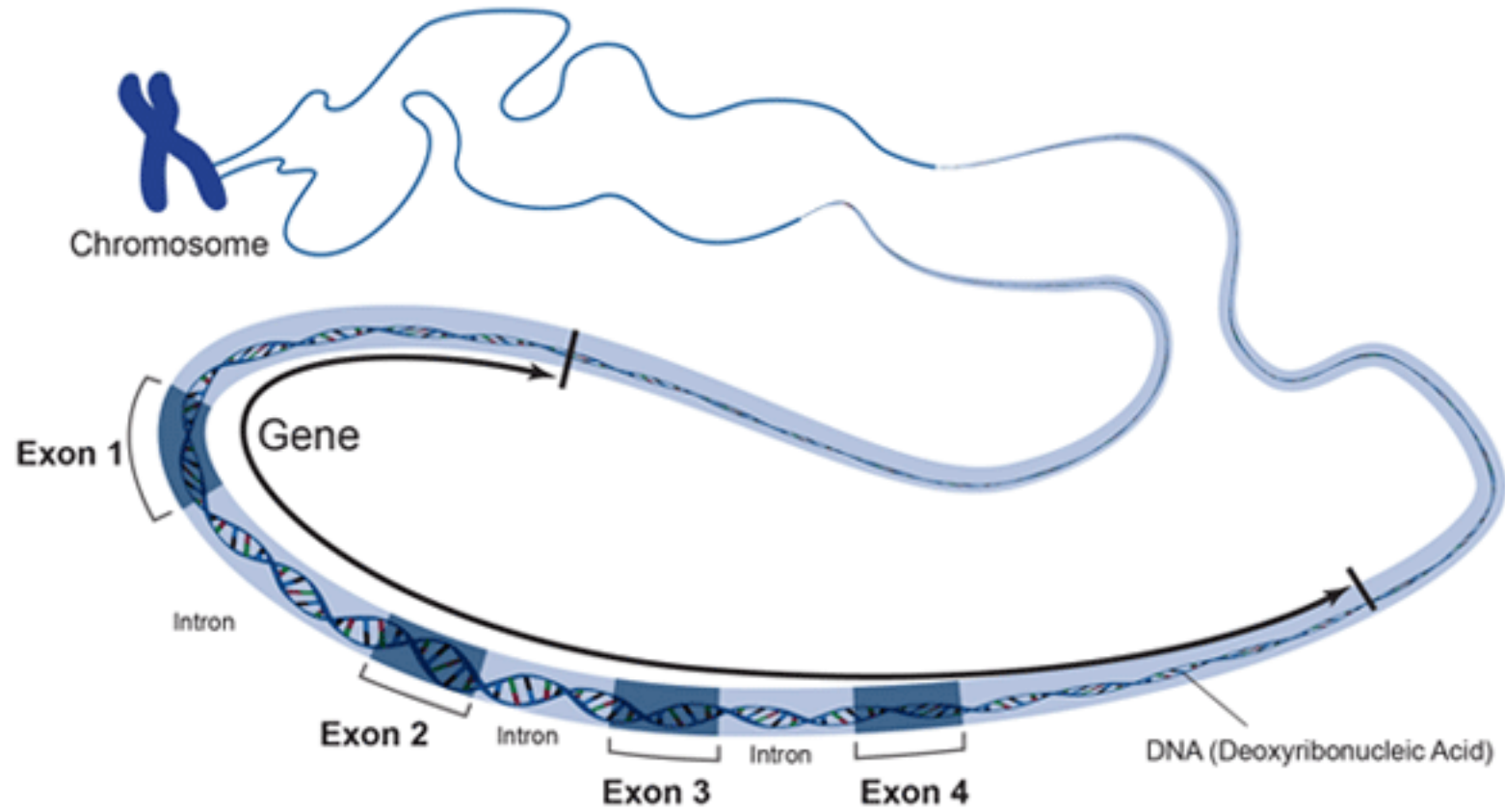
李克强对蒙古国进行正式访问并出席第十一届亚欧首脑会议



What is a gene?



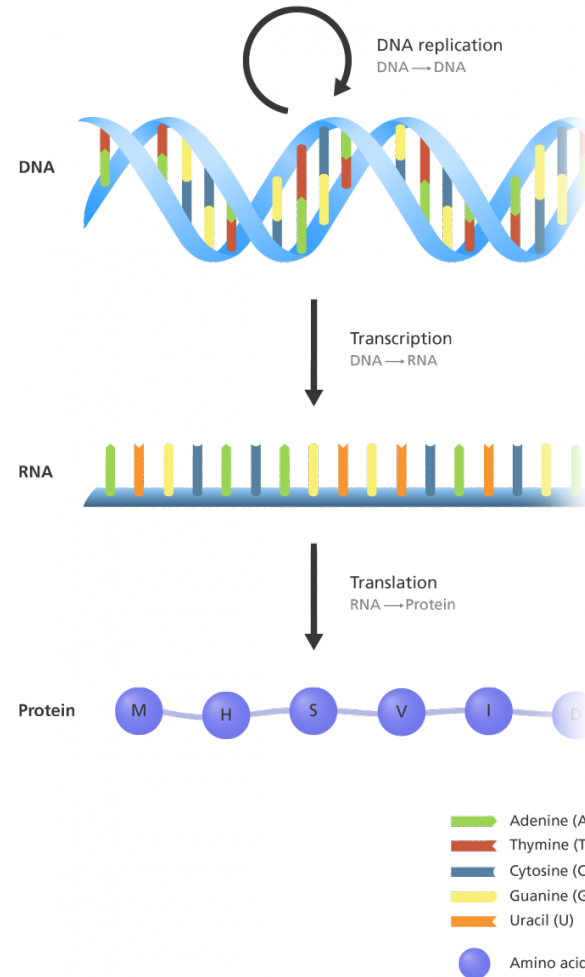
What is a gene?



What is a gene?



Genes contain useful information

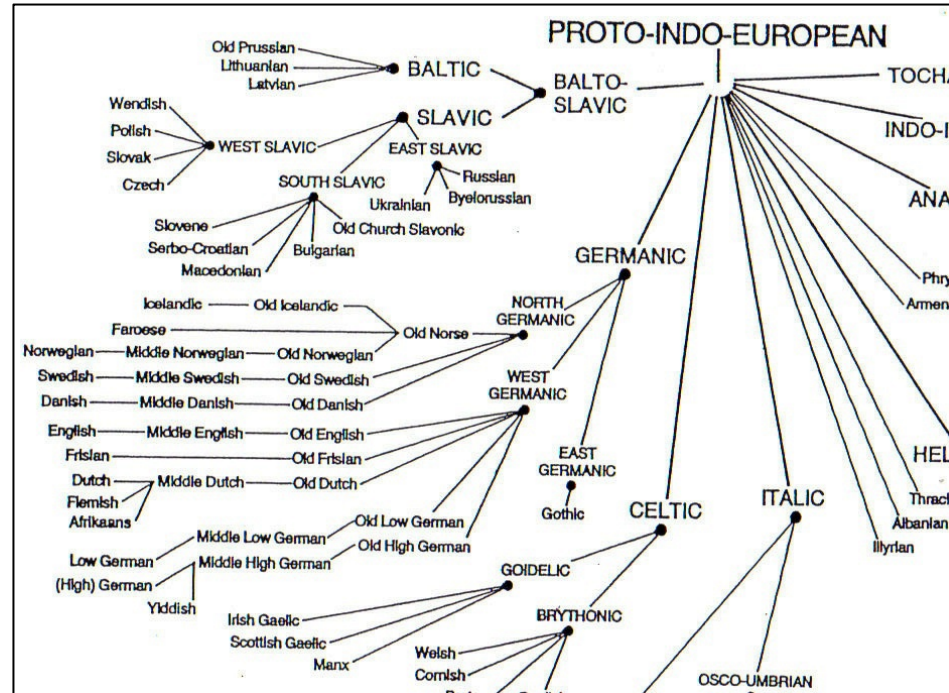


Genes contain useful information



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| English | Dutch | German | Danish | Norwegian | Swedish | Icelandic |
|-----------|---------|---------|--------|-----------|---------|-----------|
| book (n) | boek | buch | bog | bok | bok | bók |
| come (v) | komen | kommen | komme | komme | komma | koma |
| drink (v) | drinken | trinken | drikke | drikke | dricka | drekka |

DNA Subway demo

FAST TRACK TO GENE ANNOTATION AND GENOME ANALYSIS

Username:
Password:

[Forgot Password?](#) [Register](#)

DNA SUBWAY

Annotate a Genomic Sequence (Red line): Find Repeats, Predict Genes, Search Databases, Build Models

Prospect Genomes Using TARGET (Yellow line): Search Genomes, Alignment & Tree Viewer

Determine Sequence Relationships (Blue line): Assemble Sequences, Add Sequences, Analyze Sequences

Next Generation Sequencing (Green line): Manage Data, Analyze Transcriptome

Microbiome Analysis (Purple line): Metadata + QC, Clustering Sequences, Alpha/Beta Diversity

Browsers & Transfer (Central station)

DNA Subway ties together key bioinformatics tools and databases to assemble gene models, investigate genomes, work with phylogenetic trees and analyze DNA barcodes. Roll over the "stations" on the subway map to find out more about the analysis steps. Analyze your own data or sample data provided. To start a project, select one of the "lines" (red, yellow, blue, green, purple). Register and login to be able to save and share your results.

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