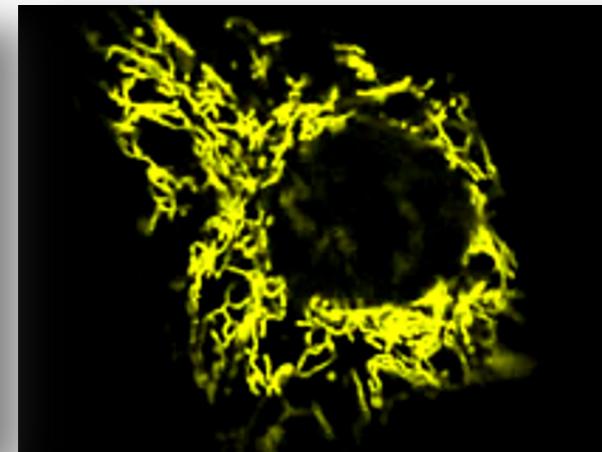
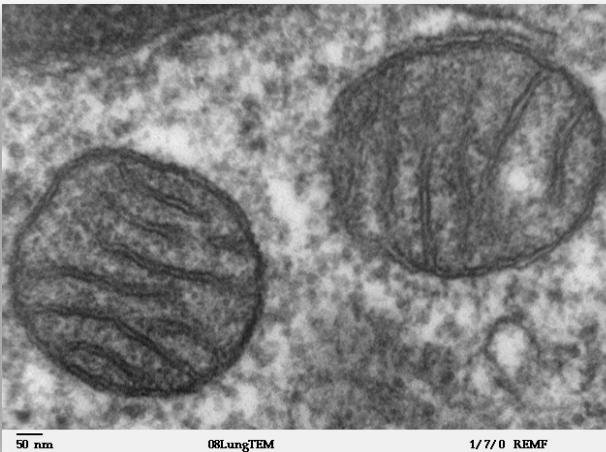
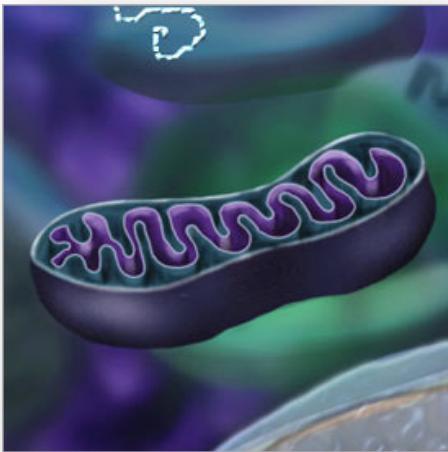
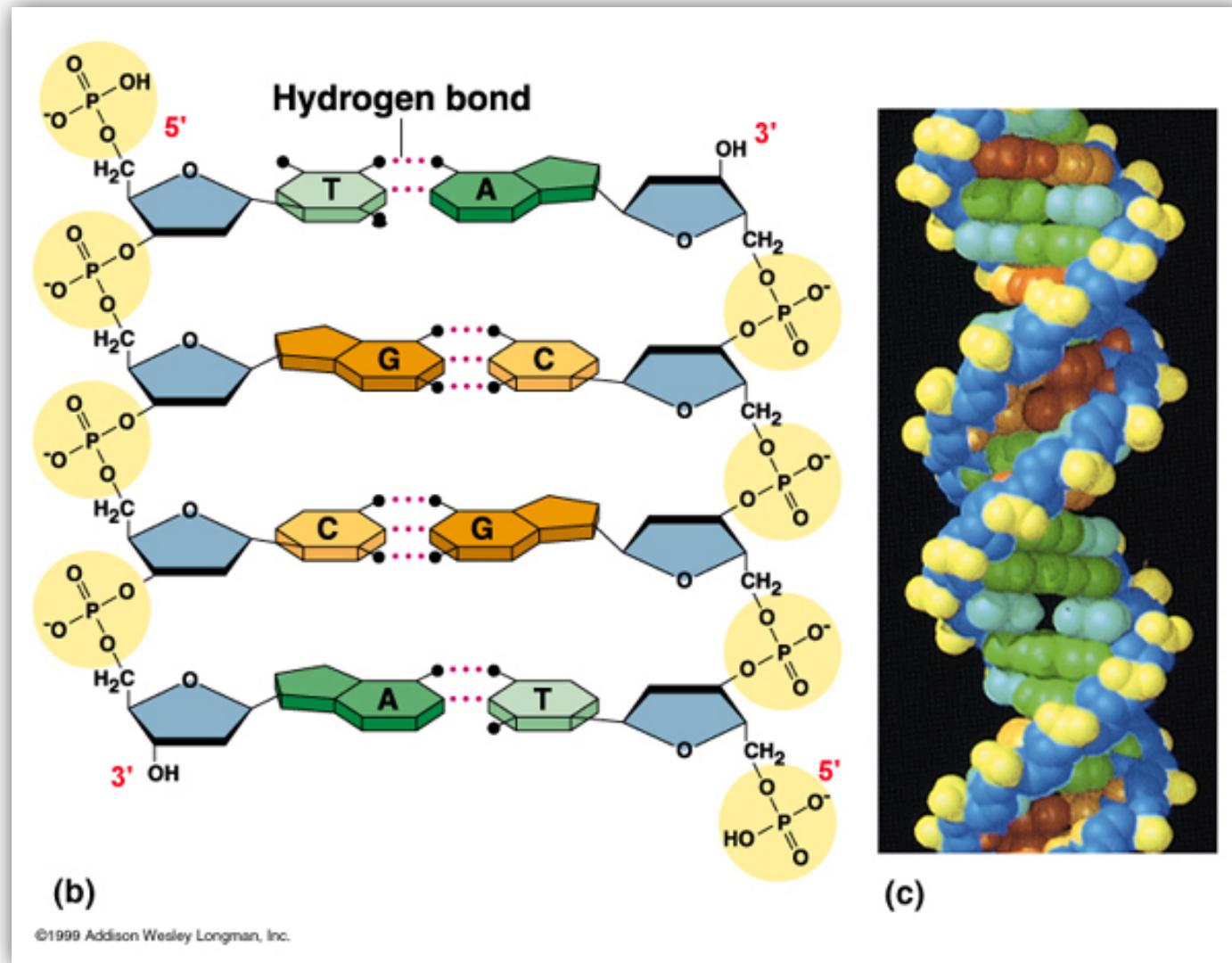


Mitochondrial DNA Basics

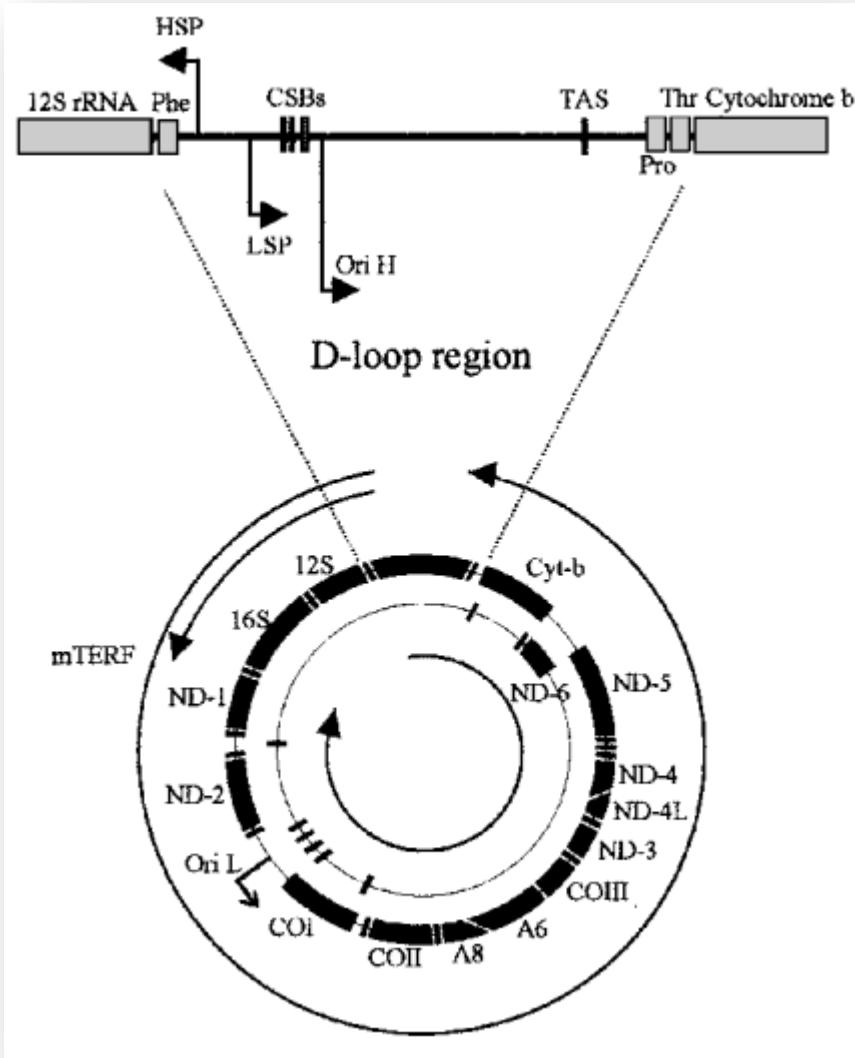
Mitochondria – the powerhouse of the cell



Mitochondrial DNA is DNA



Mitochondrial DNA Structure



**Human Mitochondrial DNA
16569 bp**



Endosymbiont Theory

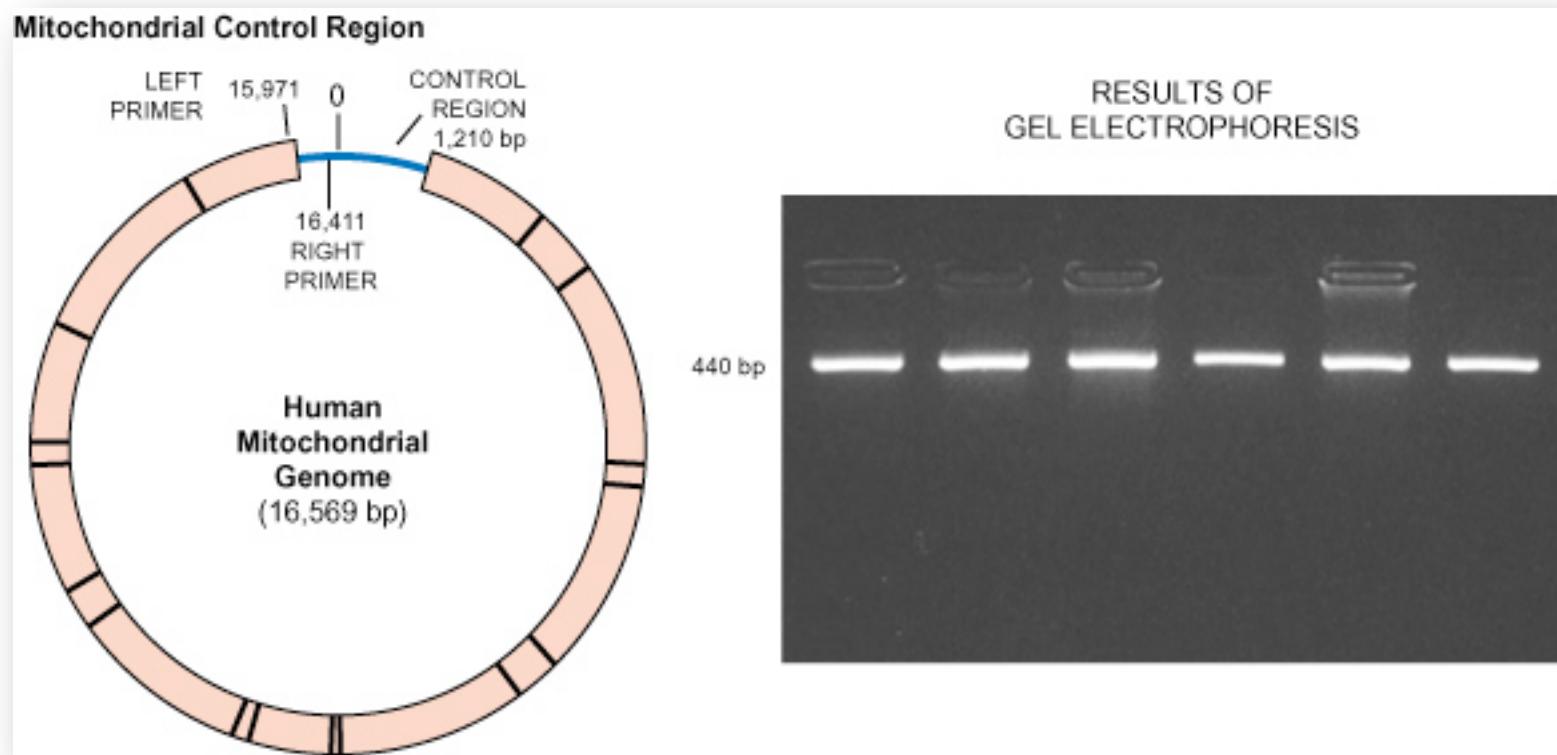


Константин Мережковский

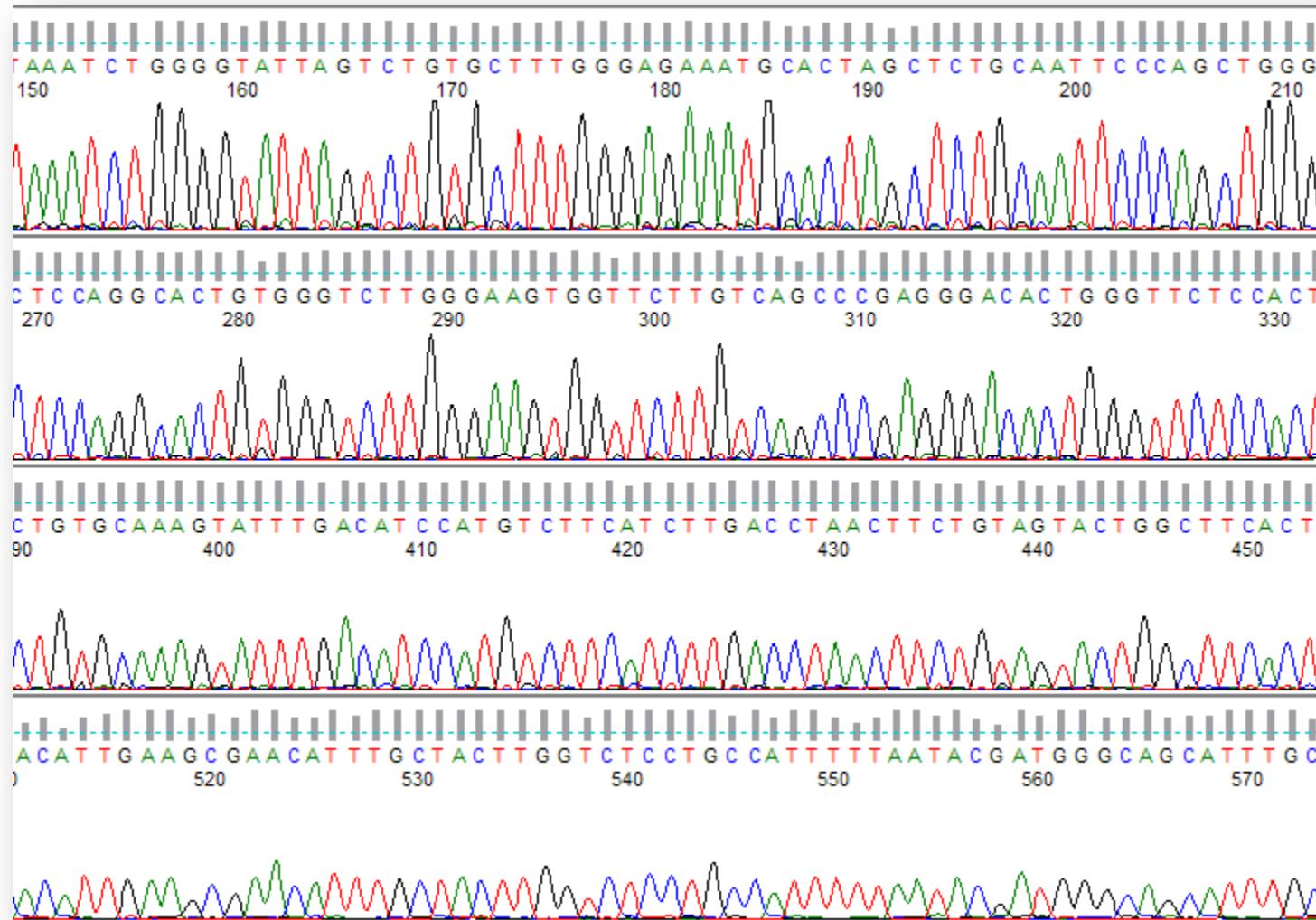


Lynn Margulis

Mitochondrial DNA – replicated by PCR



DNA Sequencing

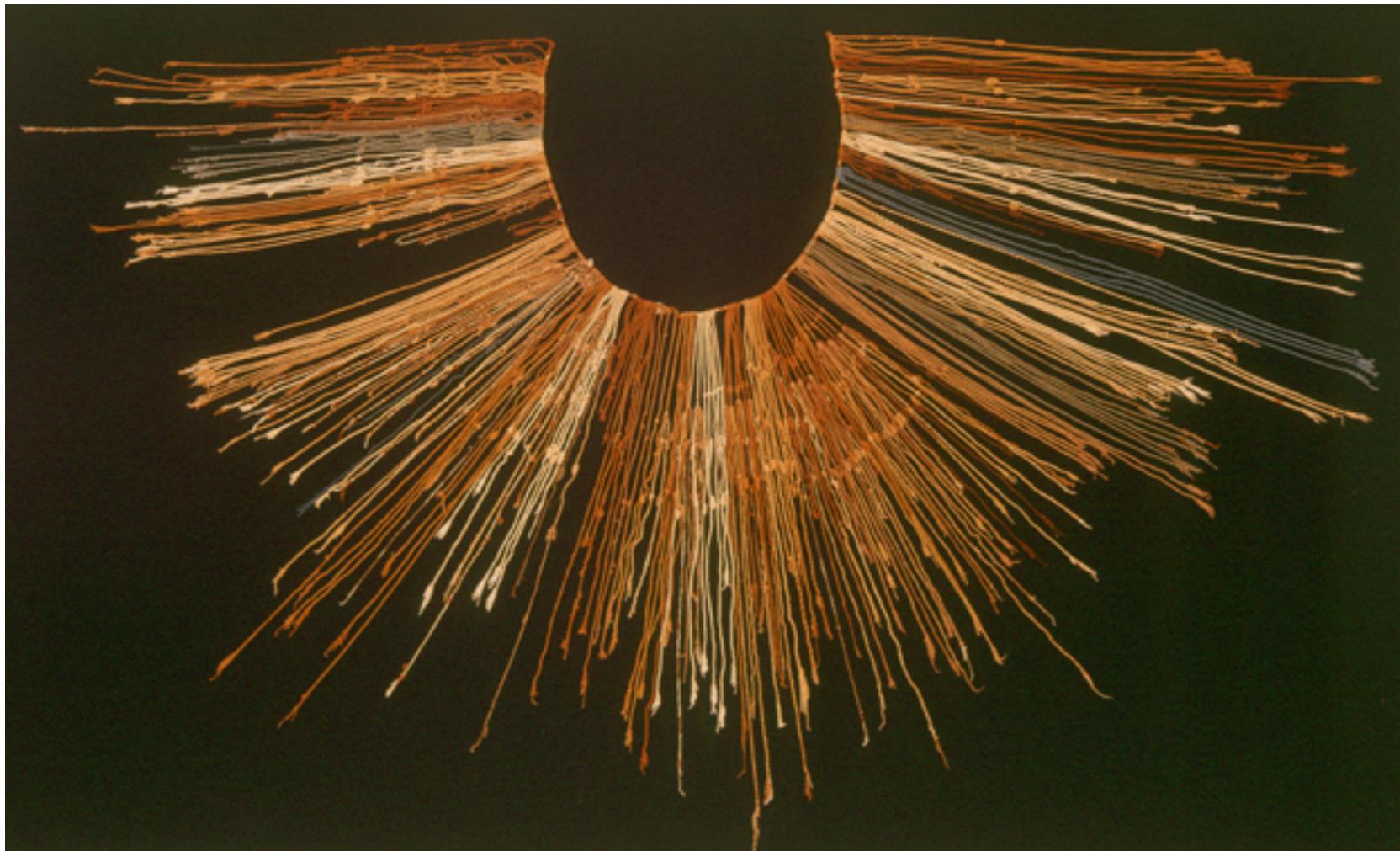


Mitochondrial genes

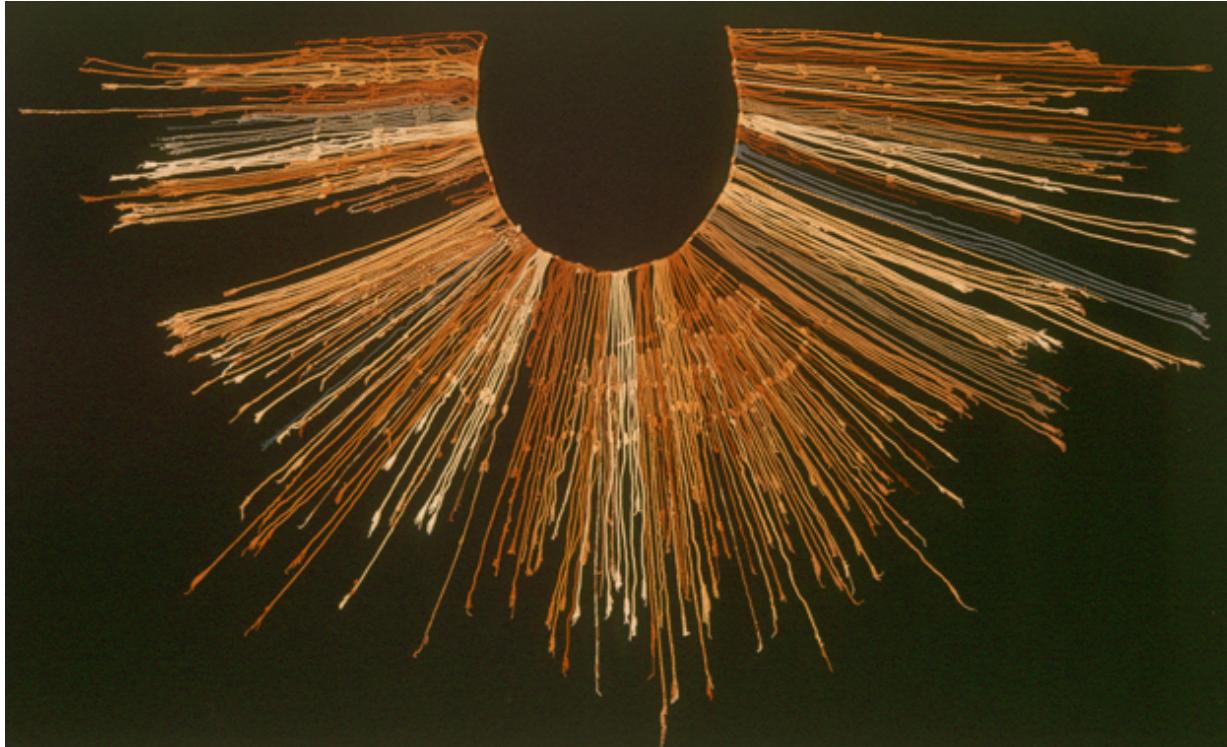
Gene Basics

Molecular biology Introduction

What is this?



Quipu



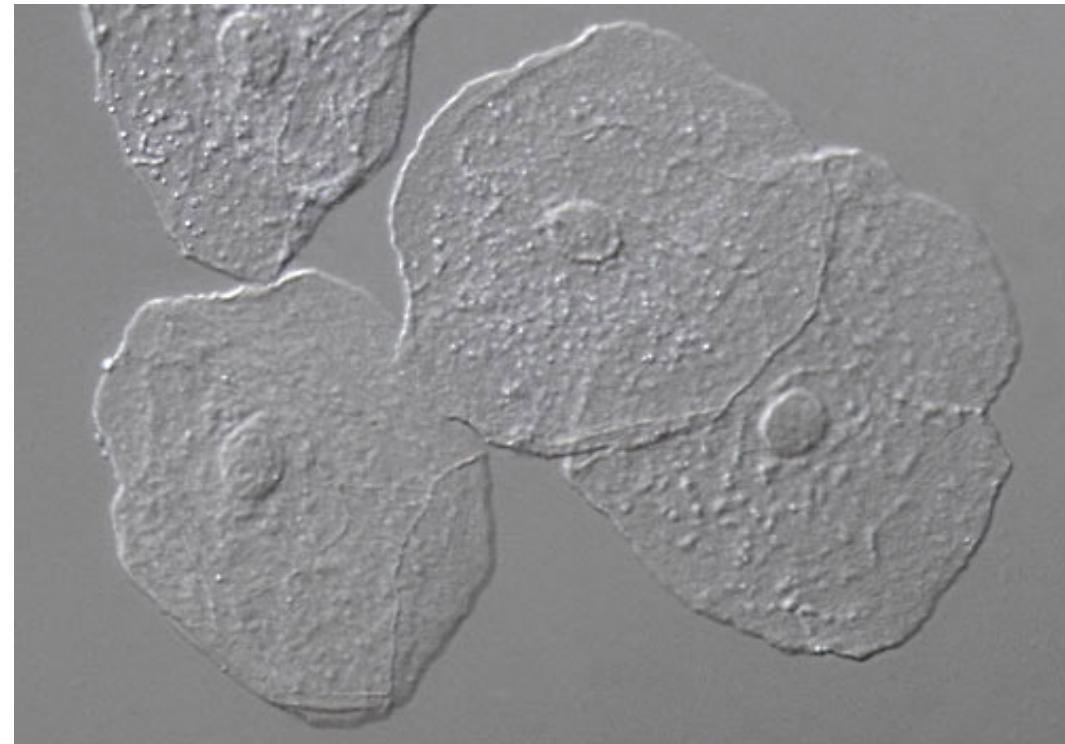
A quipu usually consisted of cotton or camelid fiber strings. The Inca people used them for collecting data and keeping records, monitoring tax obligations, properly collecting census records, calendrical information, and for military organization. The cords stored numeric and other values encoded as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

DNA – Nucleus



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

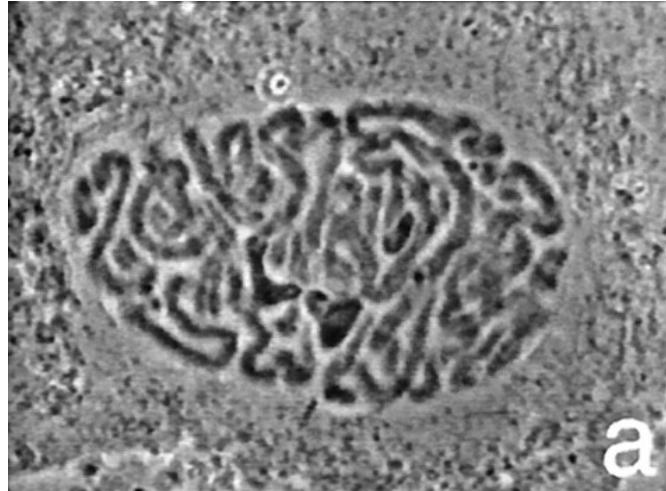
Human metaphase chromosomes



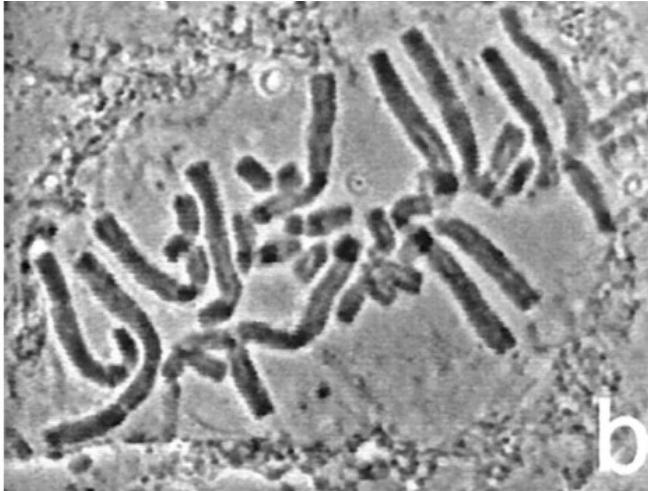
https://www.microscopyu.com/assets/gallery-images/Comparison/DIC_cheekcellsdic.jpg

Human cheek cells

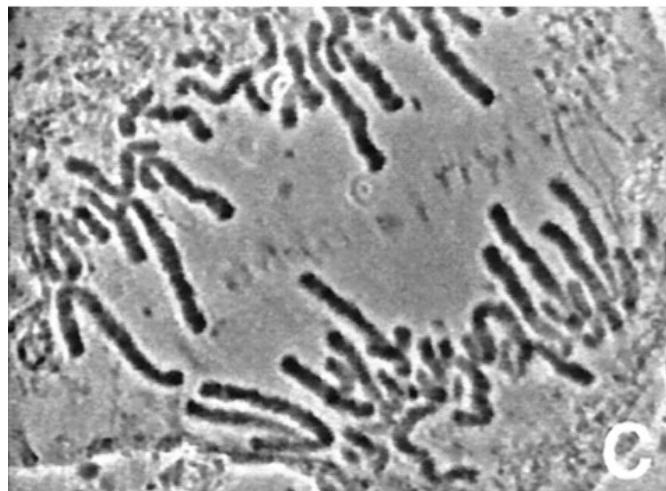
DNA - Chromosomes



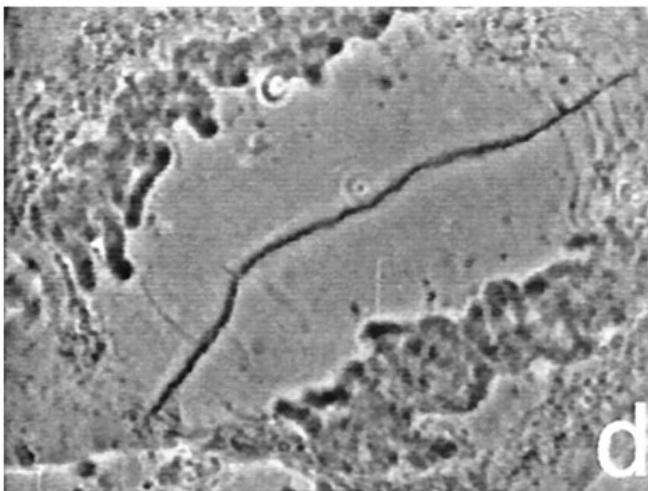
a



b



c



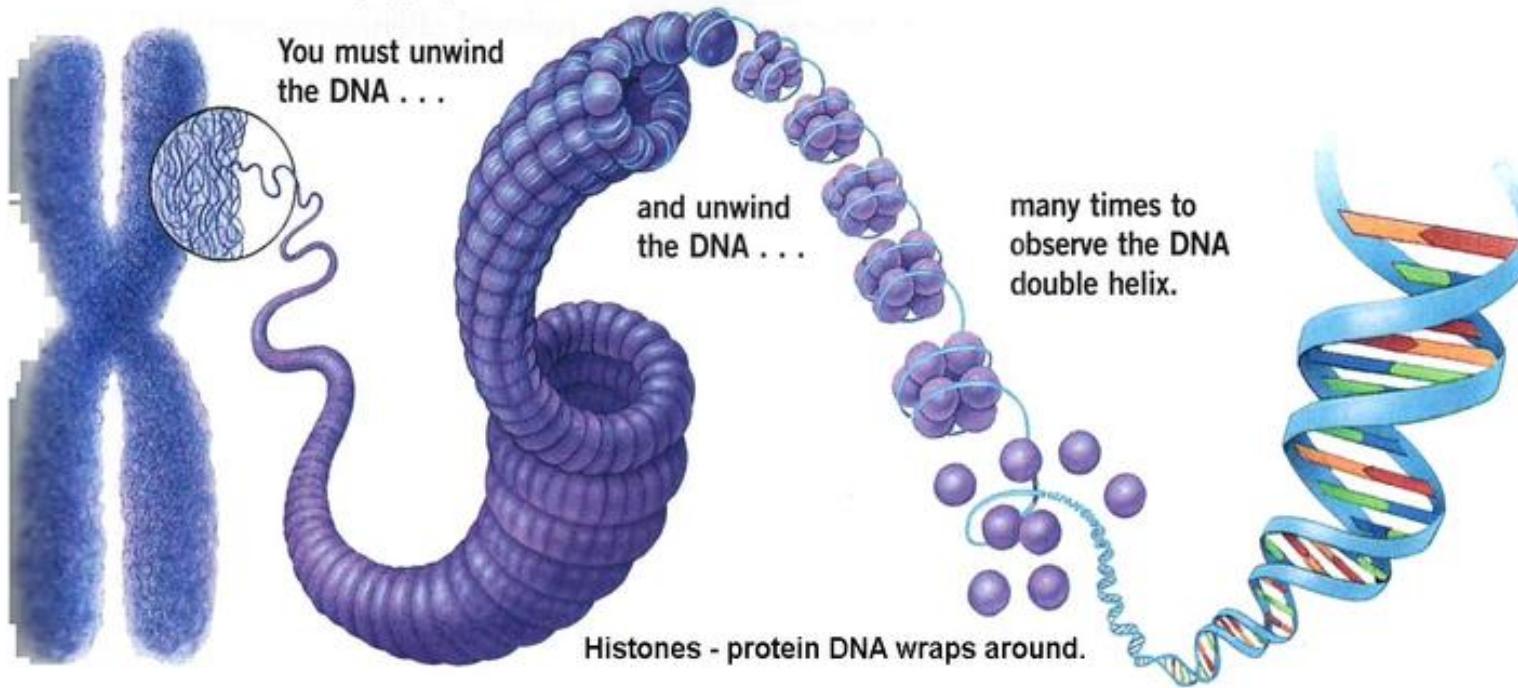
d

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.

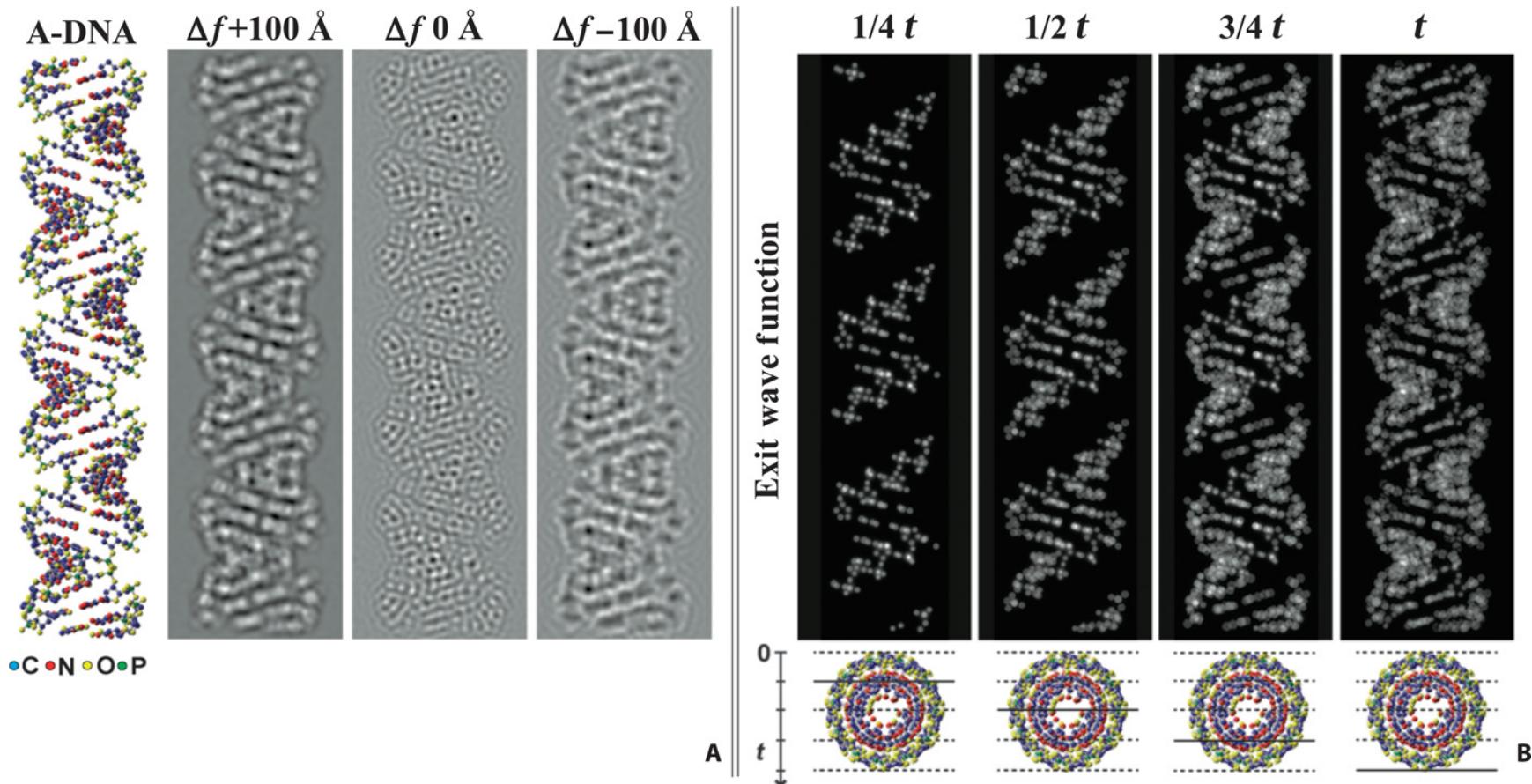
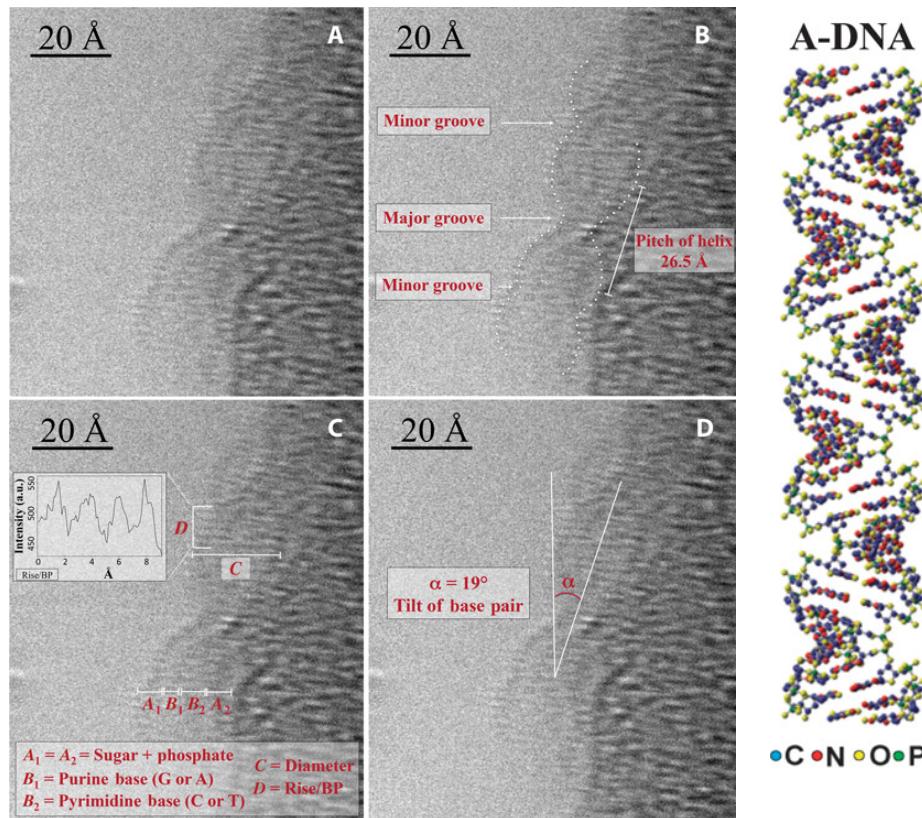
DNA - Structure

Chromosome Structure

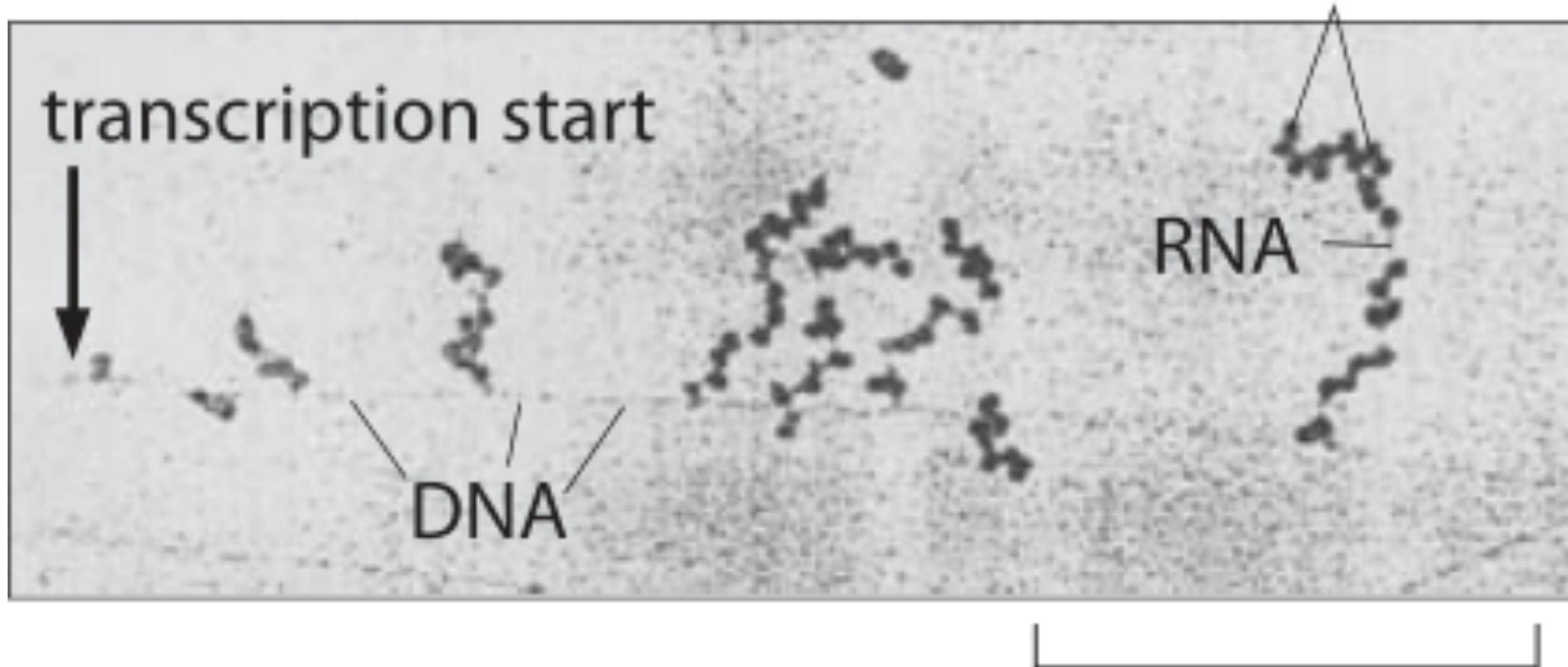
Chromosomes contain very tightly wound DNA



DNA – Electron microscopy

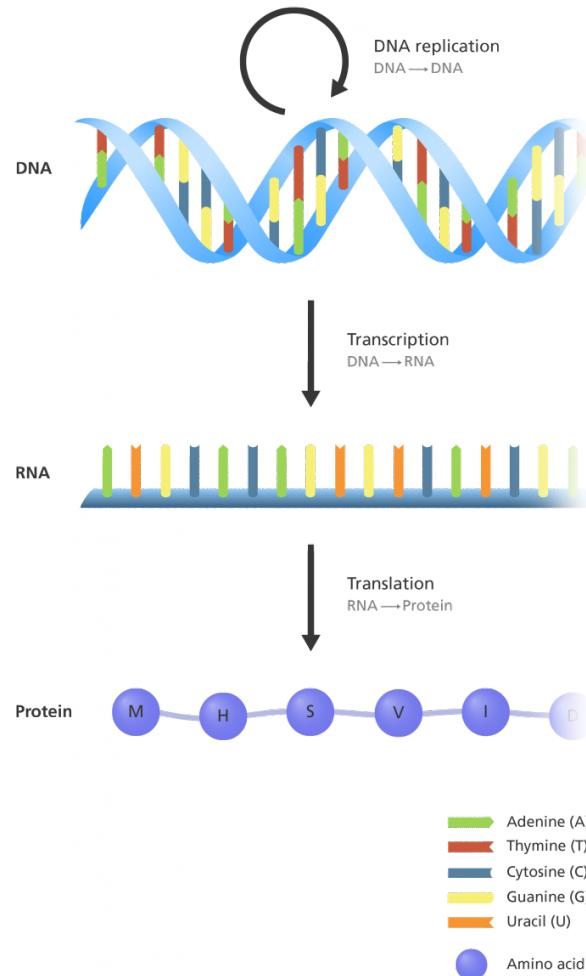


DNA – Electron microscopy ribosomes

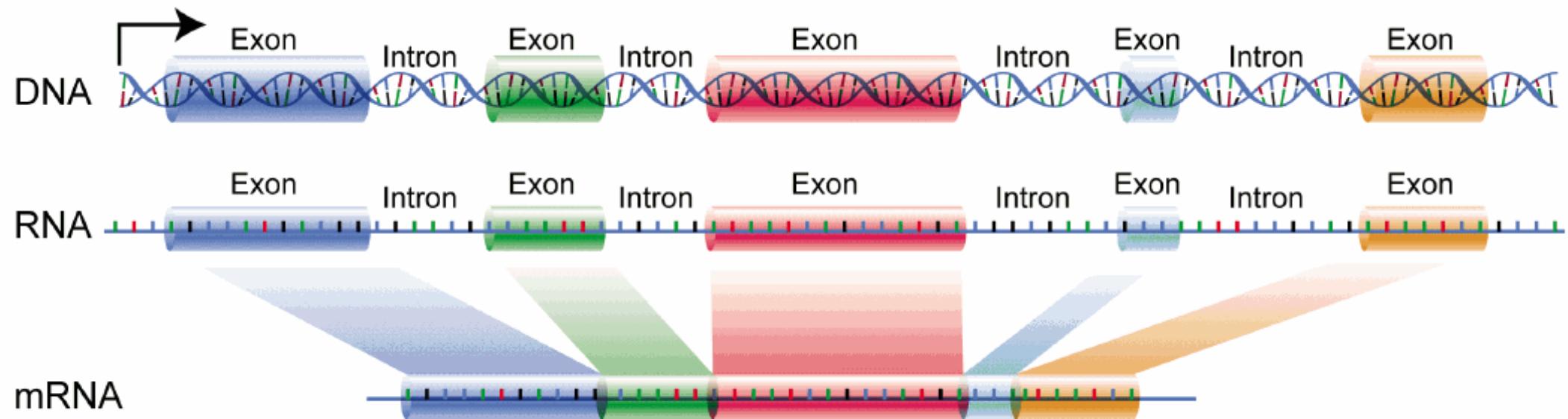


DNA Sequence

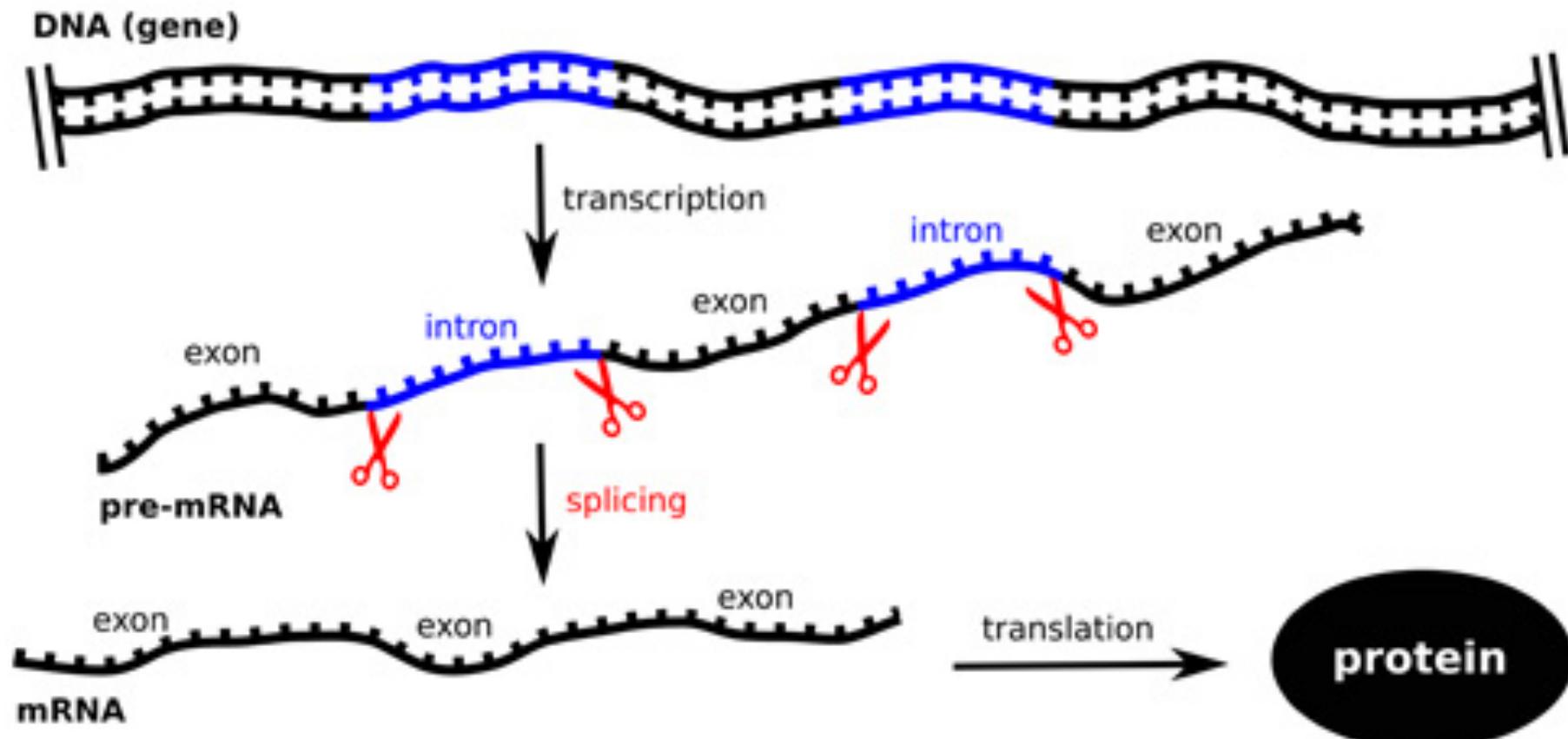
Genes contain useful information



Gene Structure

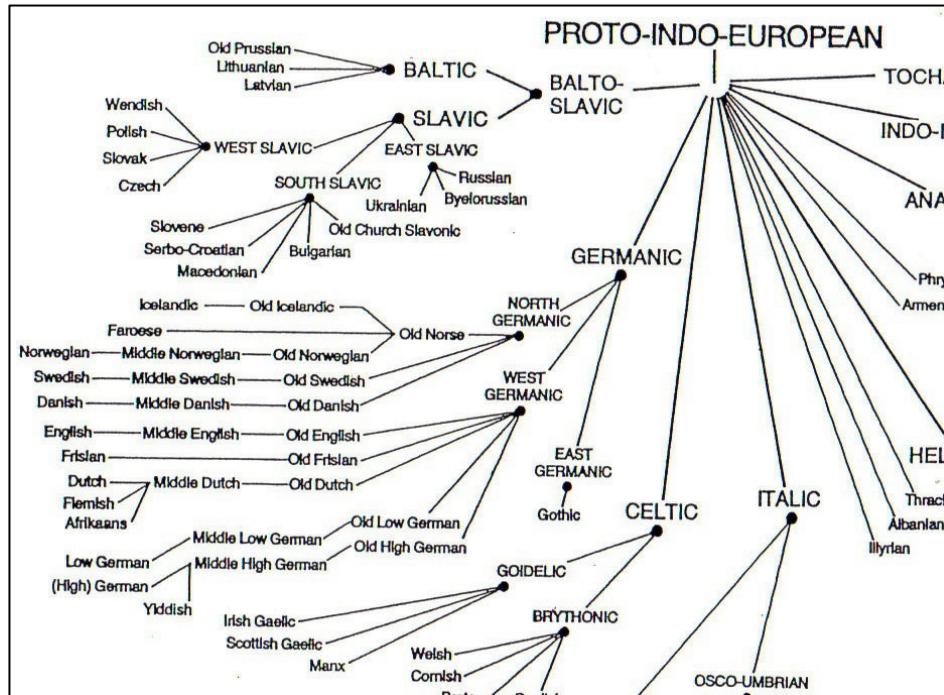


DNA Splicing



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

+ 1/2 cup butter

+ 2 eggs

+ 2 teaspoons vanilla extract

+ 1 1/2 cups all-purpose flour

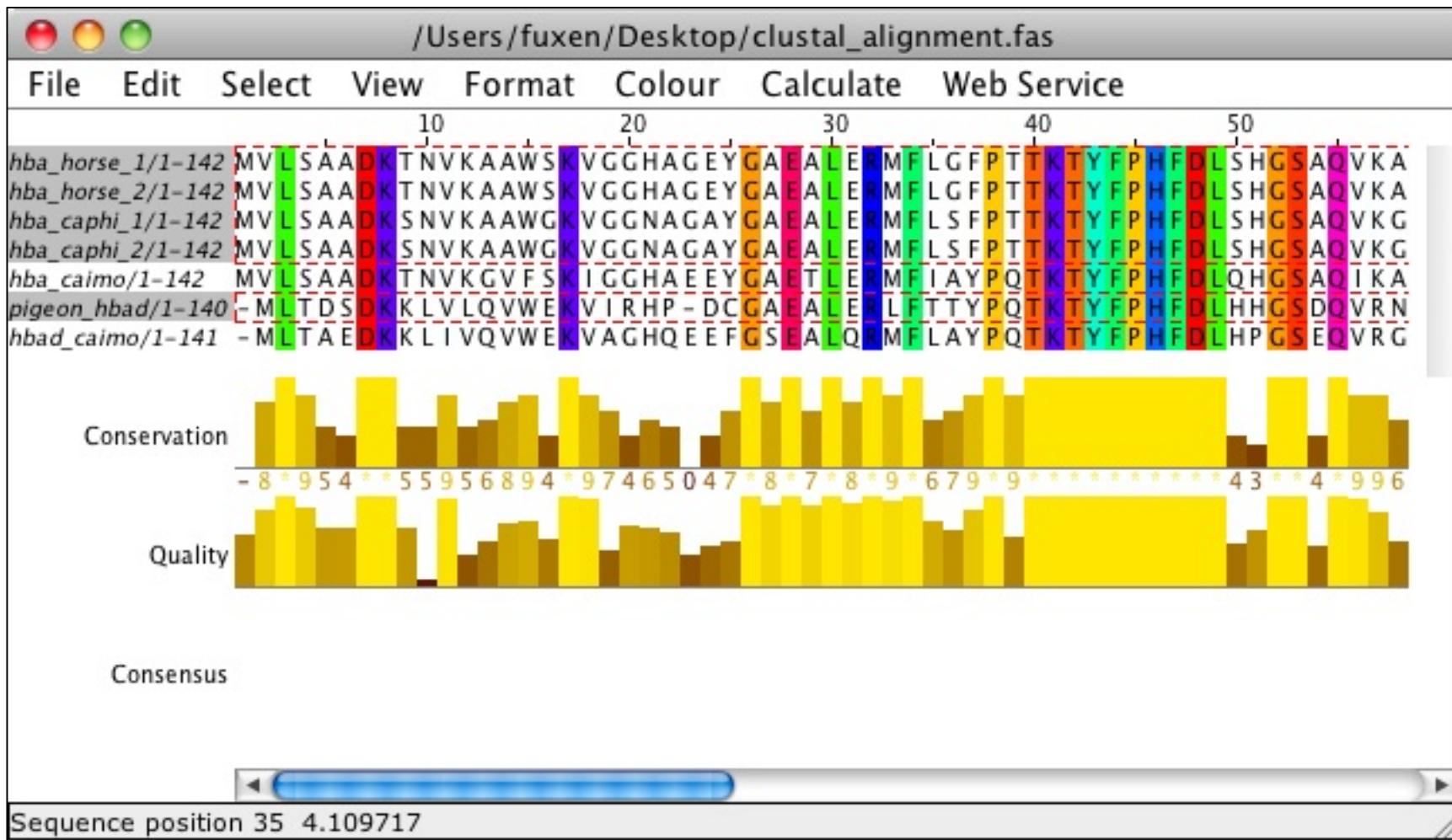
+ 1 3/4 teaspoons baking powder

+ 1/2 cup milk

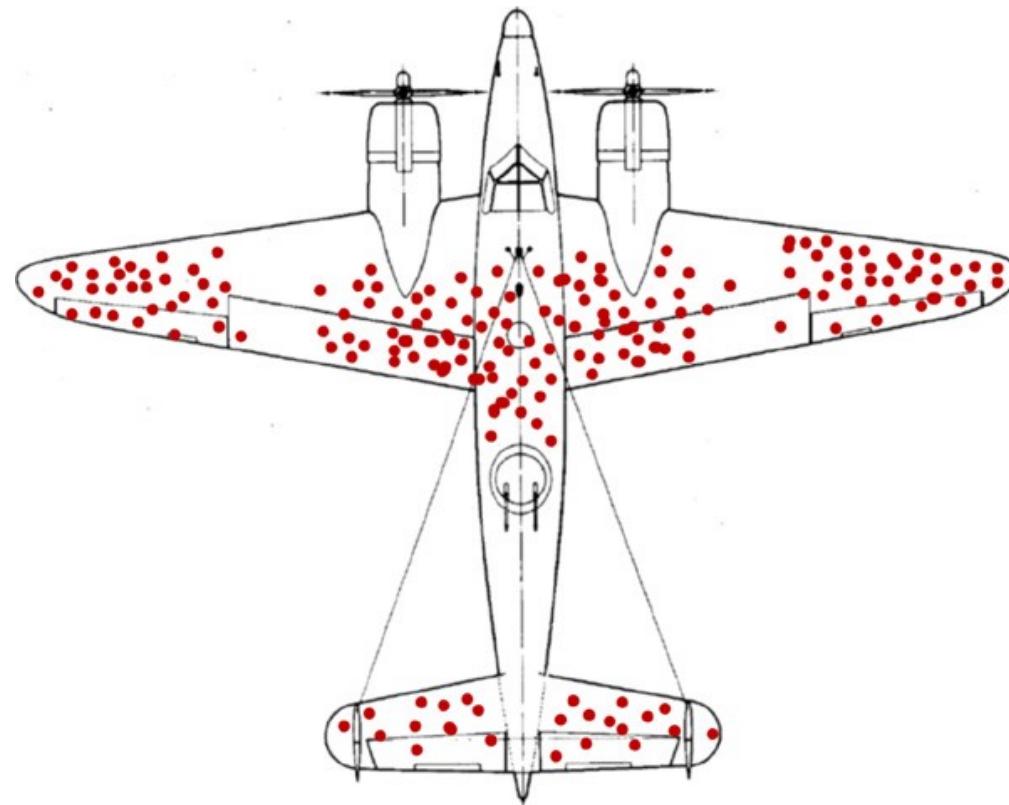
+ Add all ingredients to list



Genes can be conserved



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

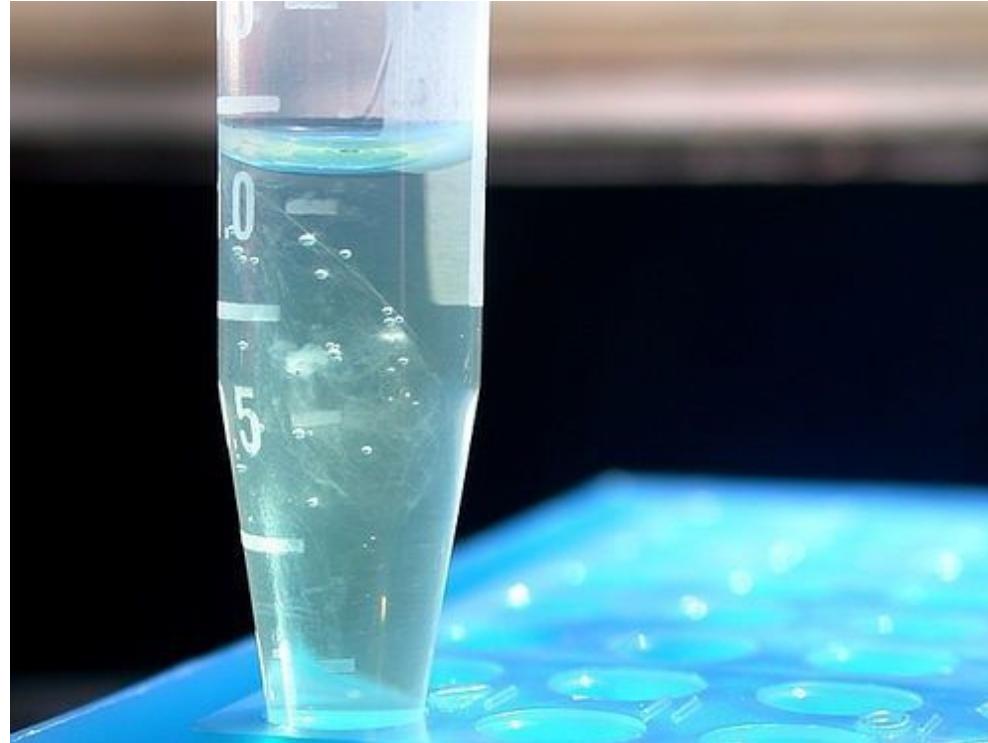
Indels

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



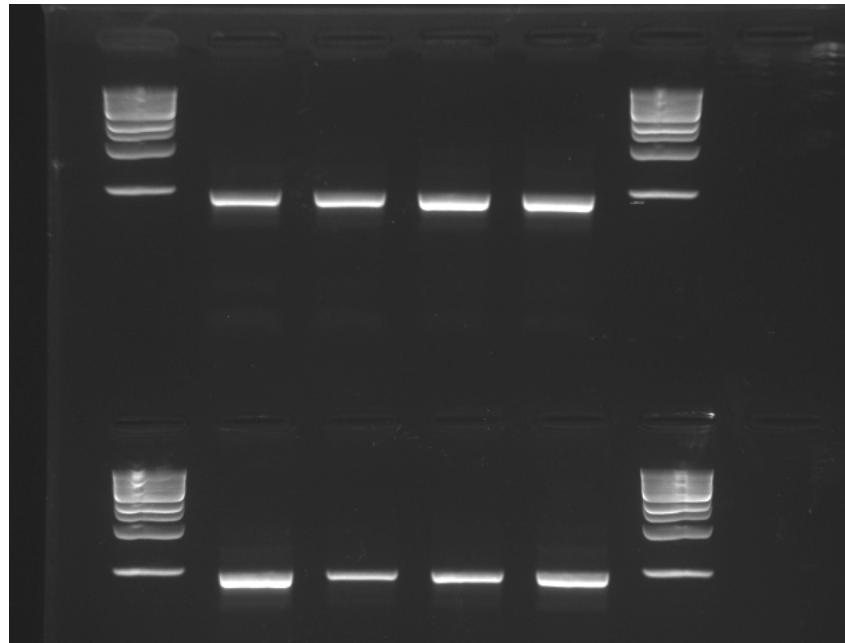
DNA Extraction from buccal cheek cells

Review: Mitochondrial lab

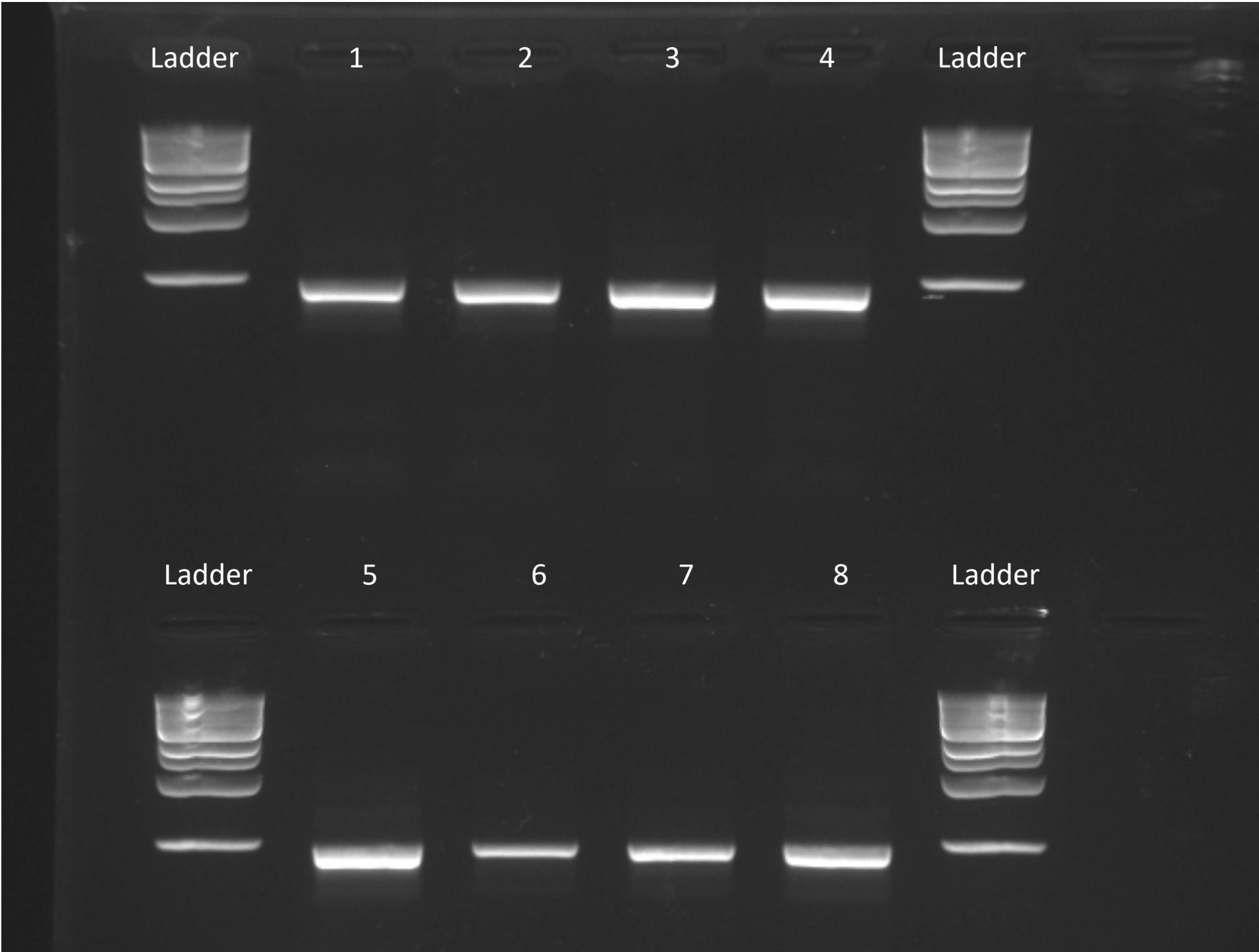


DNA Amplification by PCR

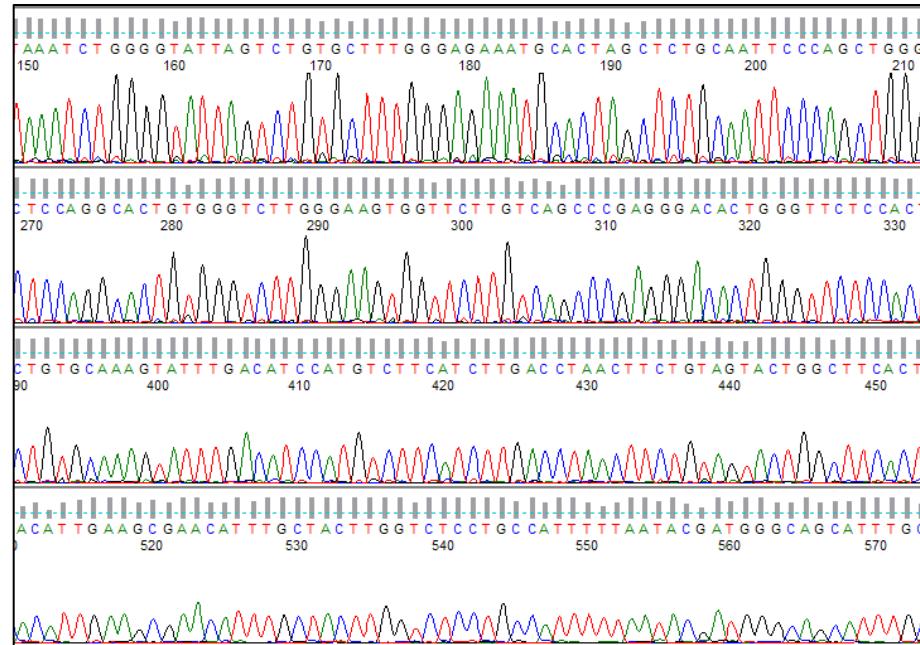
Review: Mitochondrial lab



Electrophoresis



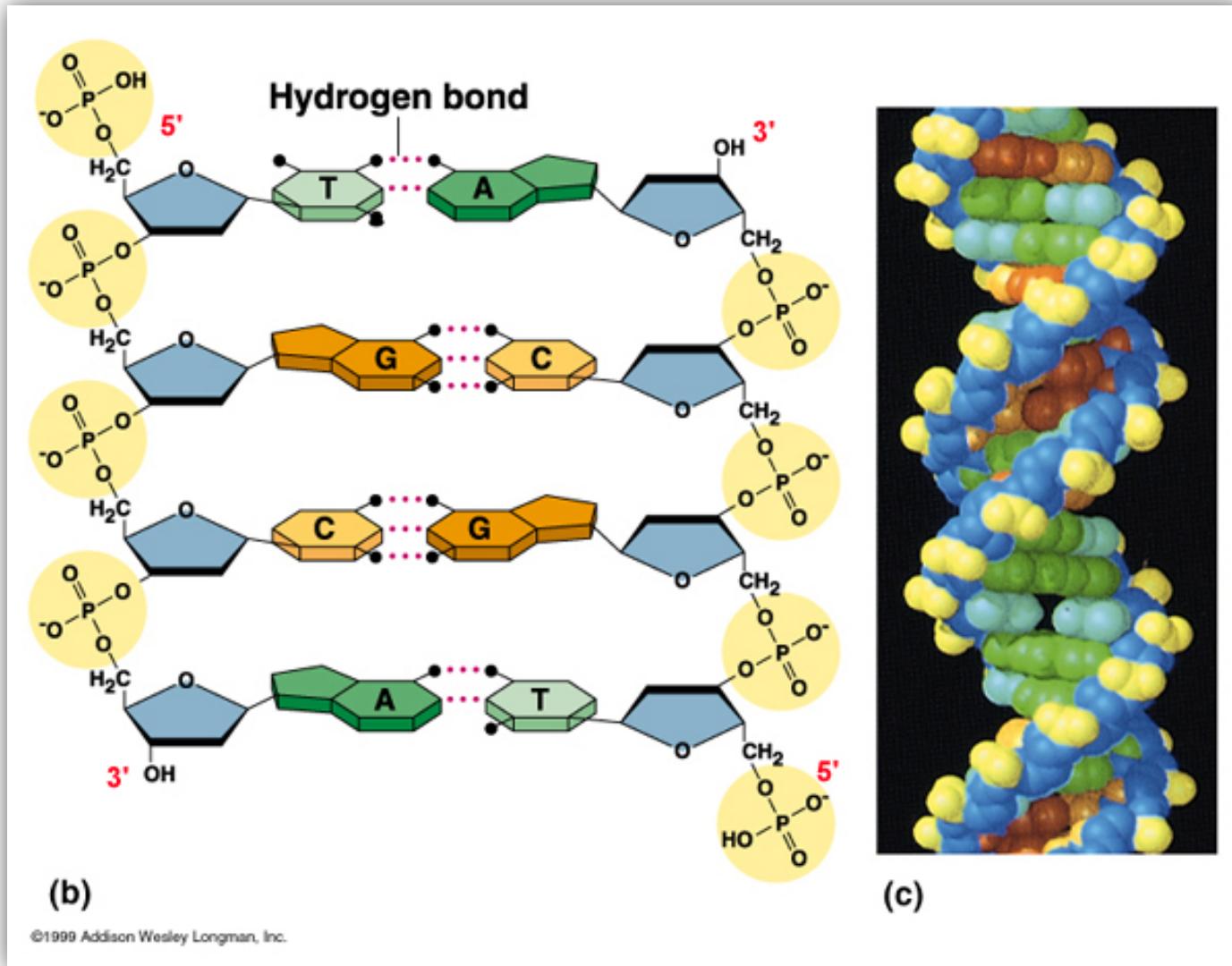
Review: Mitochondrial lab



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

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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

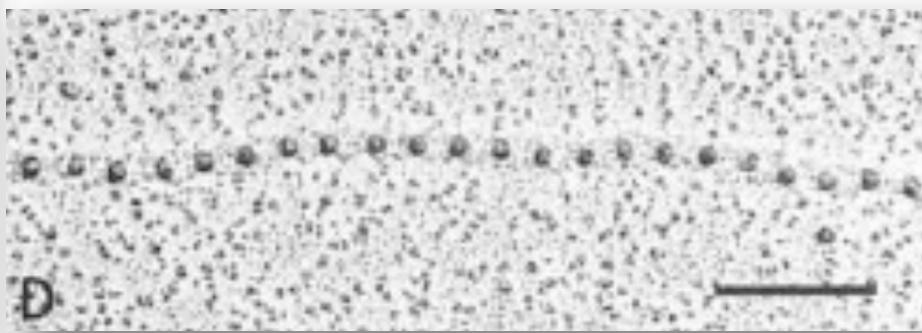
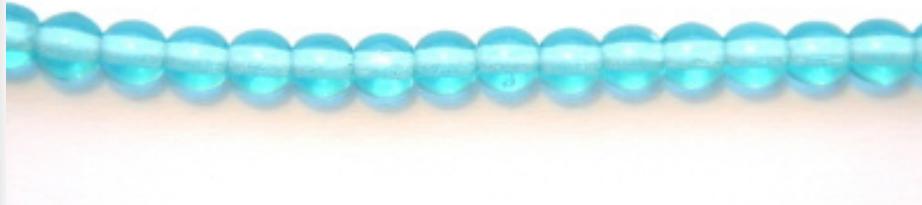
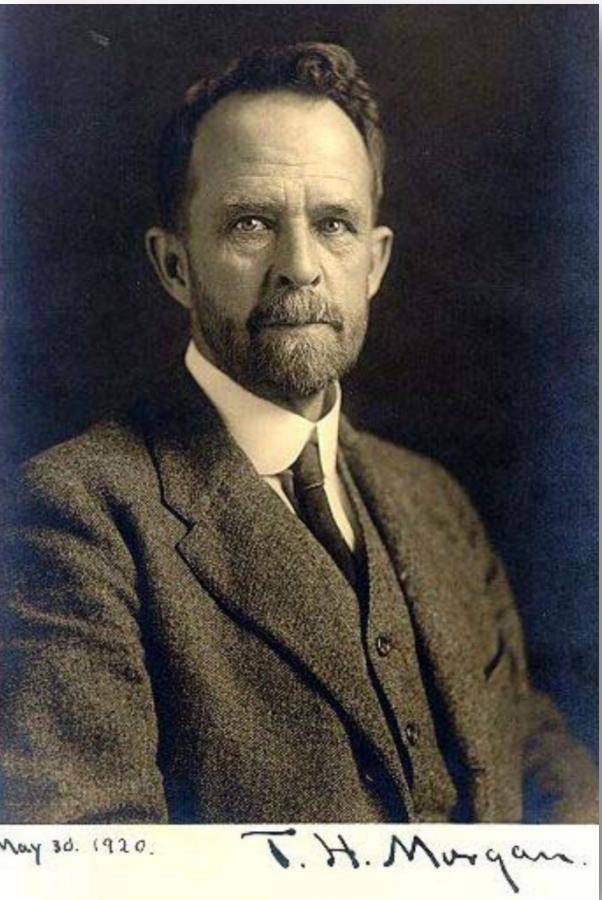
最新 仲夏时节，国家主席习近平应邀对塞、波、乌进行国事访问，并赴塔什干出席上海合作组织成员国元首理事会第十六次会议。



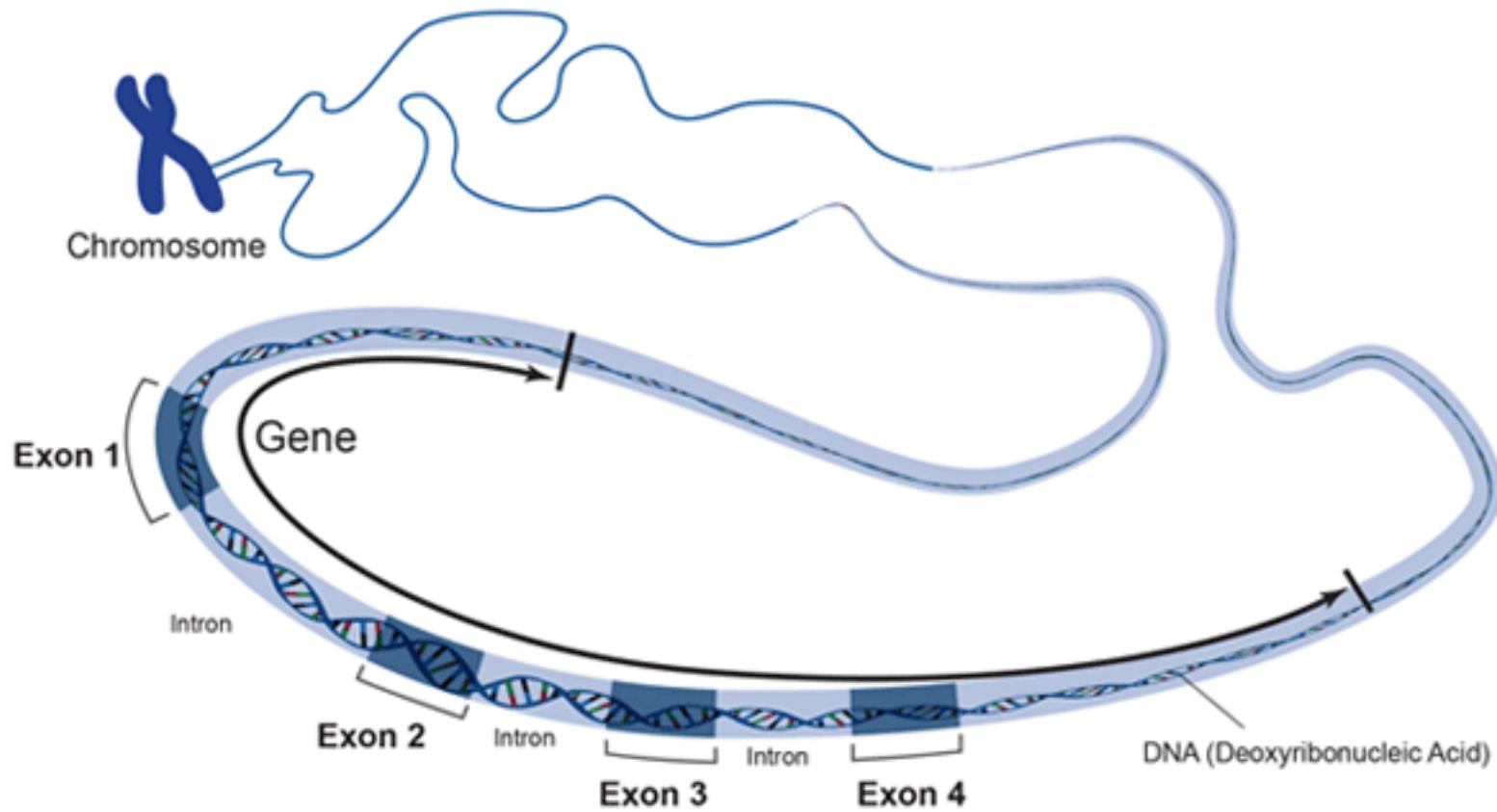
李克强对蒙古国进行正式访问并出席第十一届亚欧首脑会议



What is a gene?



What is a gene?

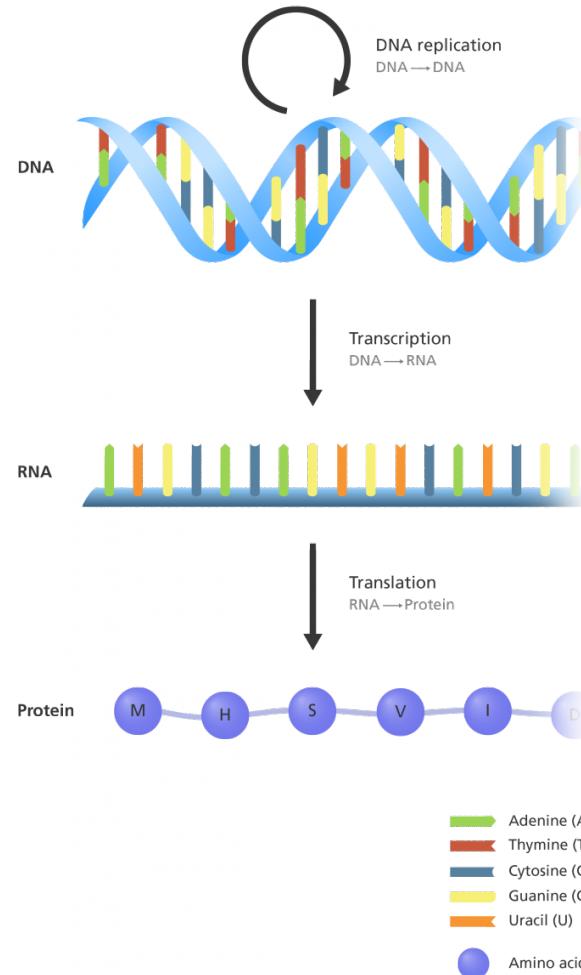


What is a gene?

A DNA sequence is shown, consisting of four horizontal rows of text. The sequence is composed of the four bases: Adenine (A), Thymine (T), Cytosine (C), and Guanine (G). Several nucleotides are highlighted in color: A's are pink, T's are light blue, C's are green, and G's are yellow. These colored bases form a diagonal path across the sequence, starting from the top-left and moving towards the bottom-right. The sequence itself is in a grey font.

CGCGGAAATCGCTAGTGGAGCTGAATATTAGCTTC
AAAATATAACGTGGATGAGCCTCCCAGGCCAA
CGAACATCAAGCCCCCTCACTGACGATGTGATA
ATGCCGGGGATAAGCTAACAGTTGTCAA
TGATTTAAACCGGCTACGTATCACACAGTTGTCAA
ACTTAGTTCTCGAAATGCACCTTCGAAGCCAG
ATGATCCCTTCCGCTTGATTAAAGGTAGGCCACAC
CCGAGACCTATTATCTGGATCTAGTGTGATTAT
TGGGATCACTACAAACACTAGGGGGCGAGCAC
CGTTTAACTTAGTTATCCAGGTCAAAGTCATT
AAAGGTGAAGCAGGTTTTATACTCGAC

Genes contain useful information

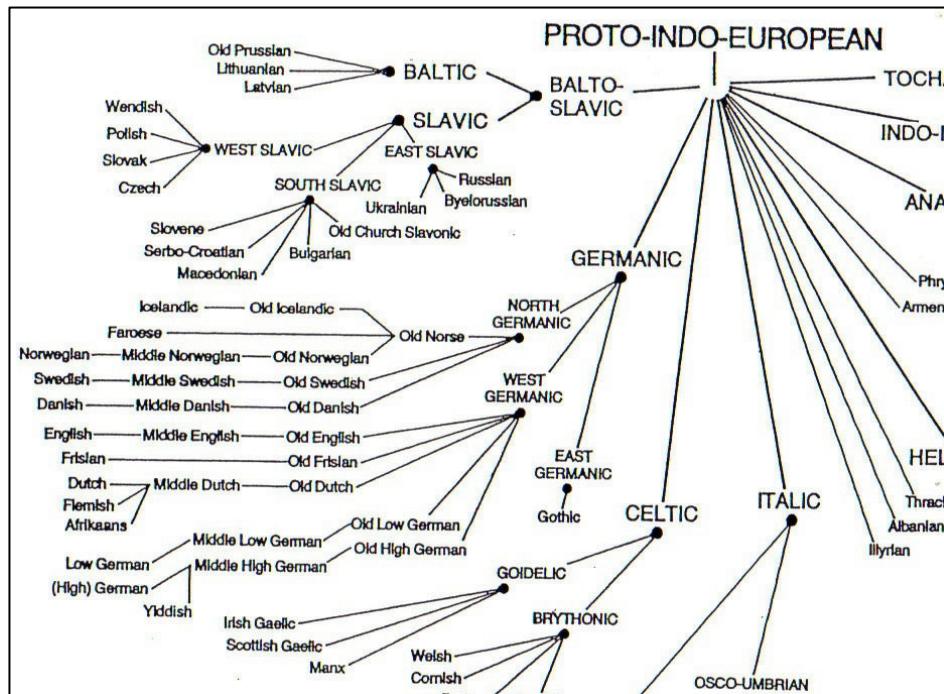


Genes contain useful information



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

DNA Subway demo

