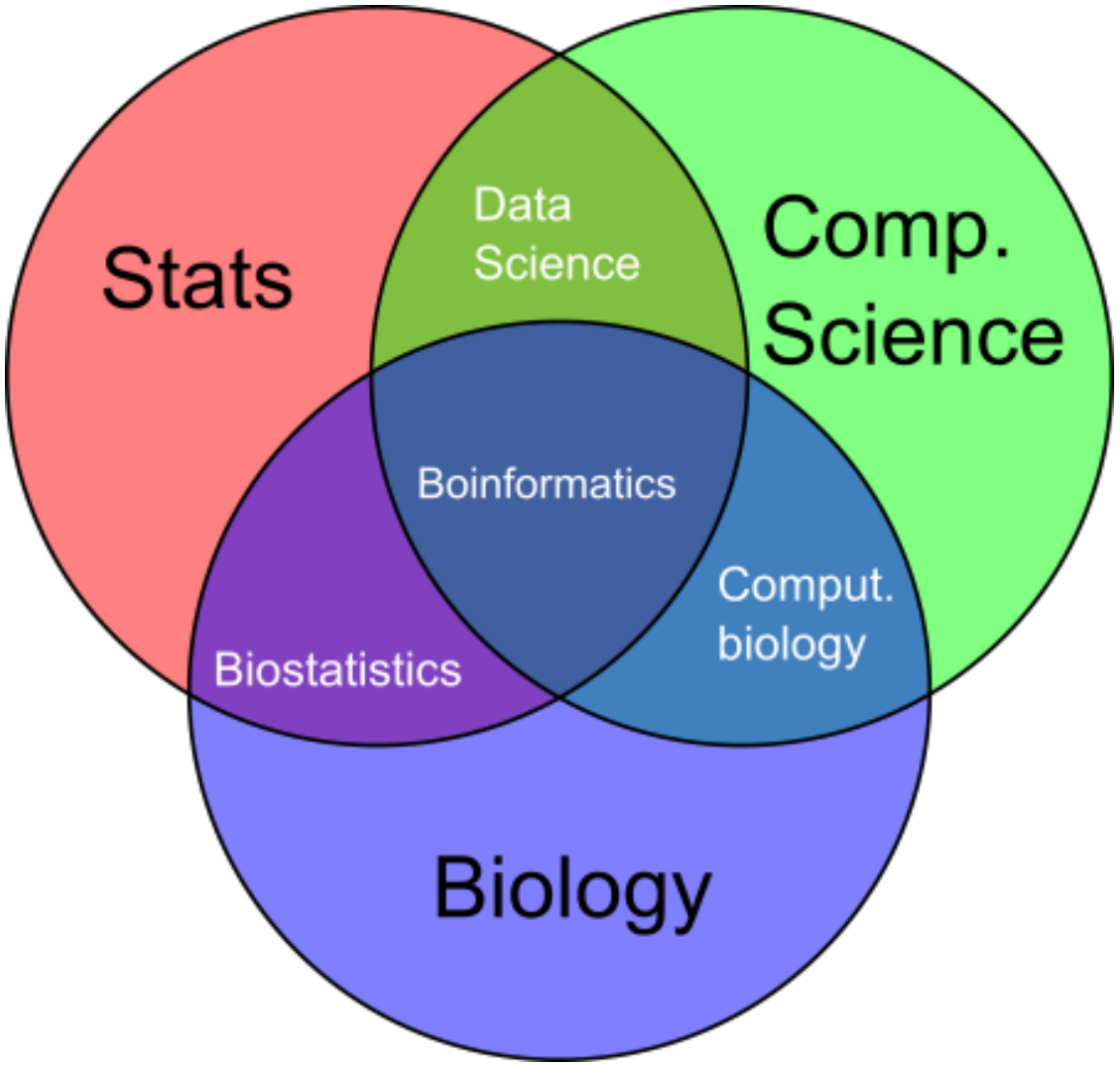
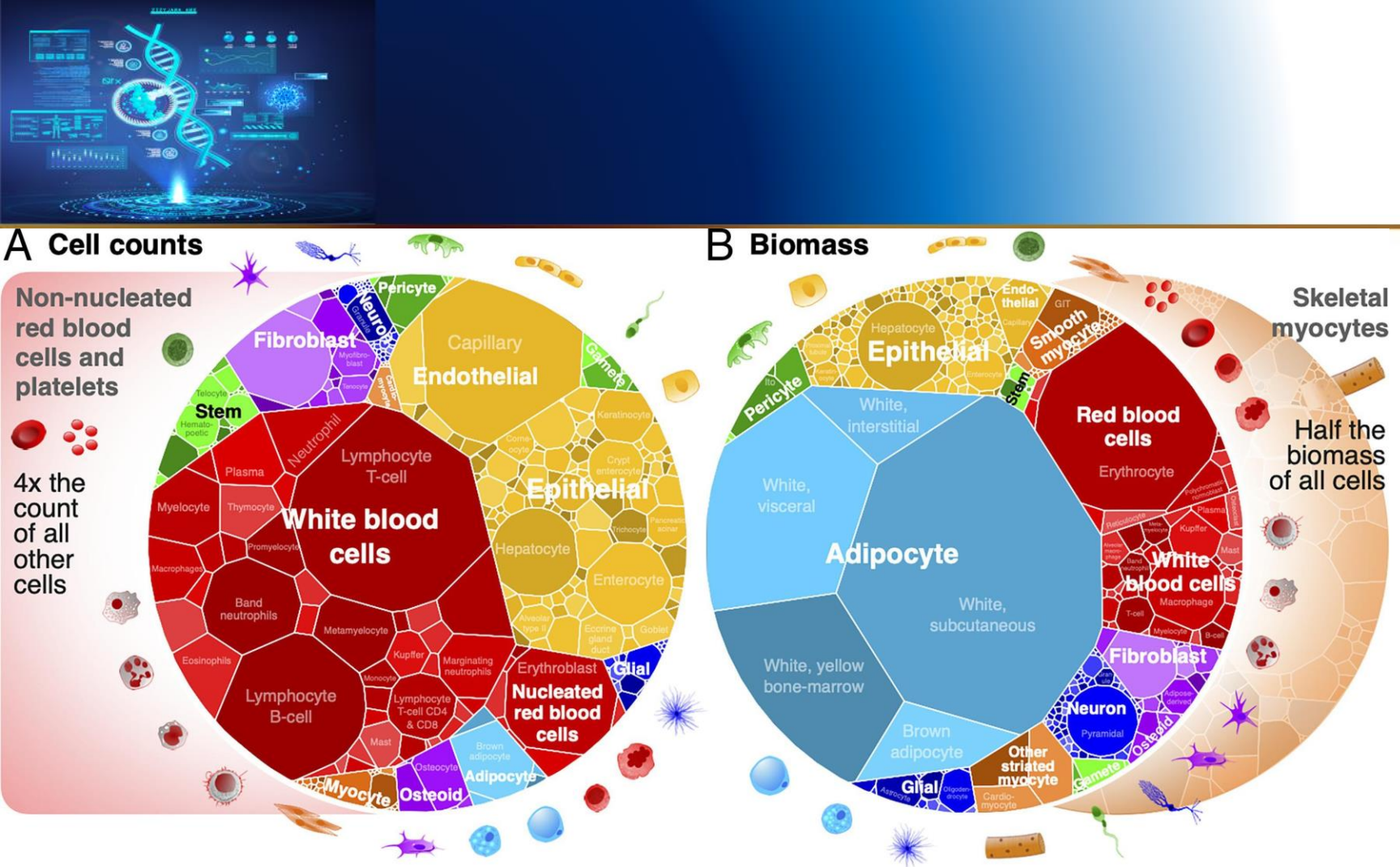
# بیوانفورماتیک




بیوانفورماتیک علم استفاده از ابزارهای کامپیوتری برای تحلیل داده‌های زیستی است در تقاطع زیست‌شناسی، علوم کامپیوتر، آمار و ریاضیات قرار دارد .




## 36 Trillion Cell !

(۳۶ با ۱۲ صفر جلوی آن)

زن بالغ ۲۸ تریلیون

کودک ۱۰ ساله حدود ۱۷ تریلیون سلول

تعداد ۴۰۰ نوع سلول

۶۰ بافت

**۴۸ جلد کتاب ۱۰۰۰ صفحه ای**

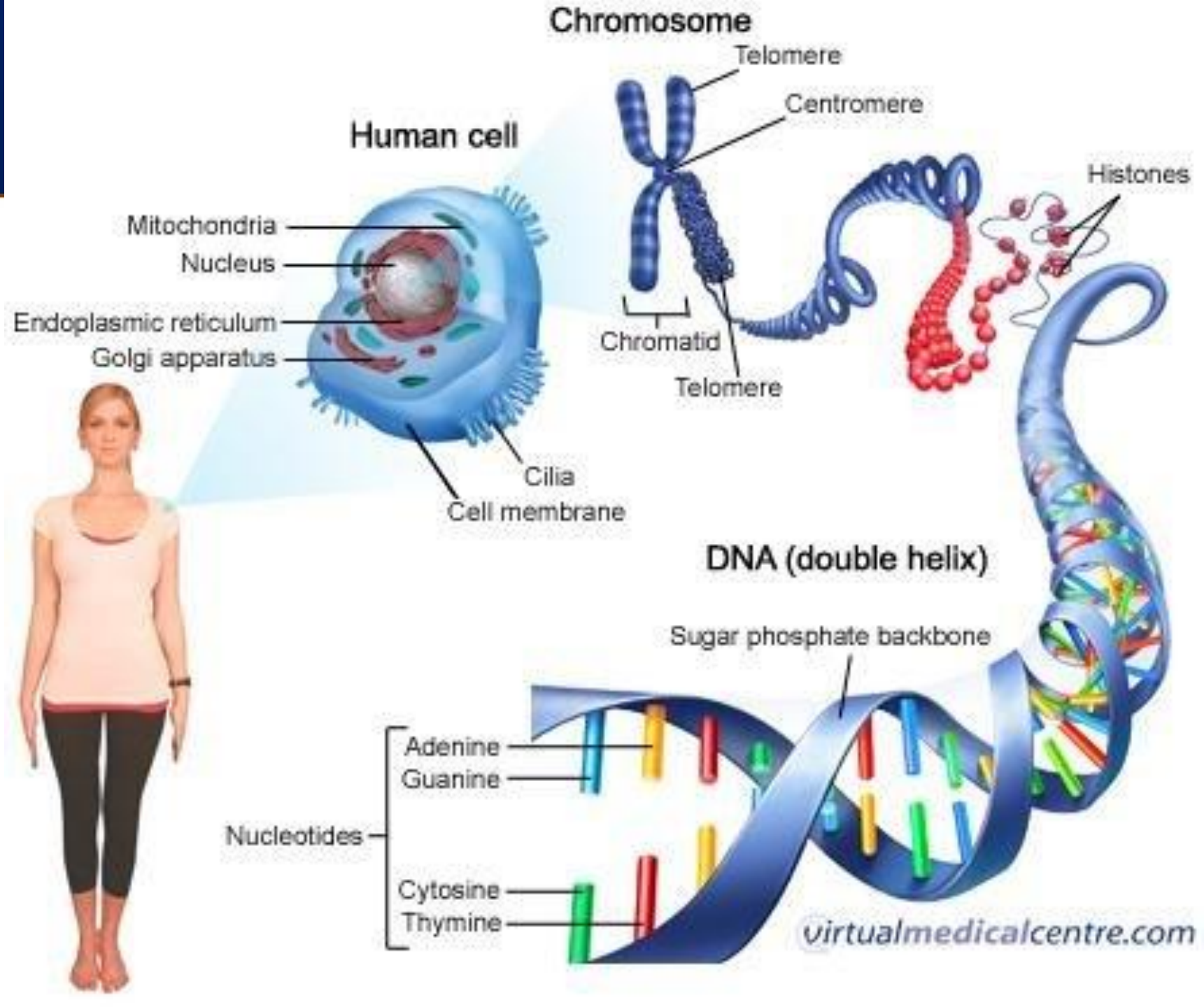
**در هر ۱ میلیمتر یک حرف**

A4

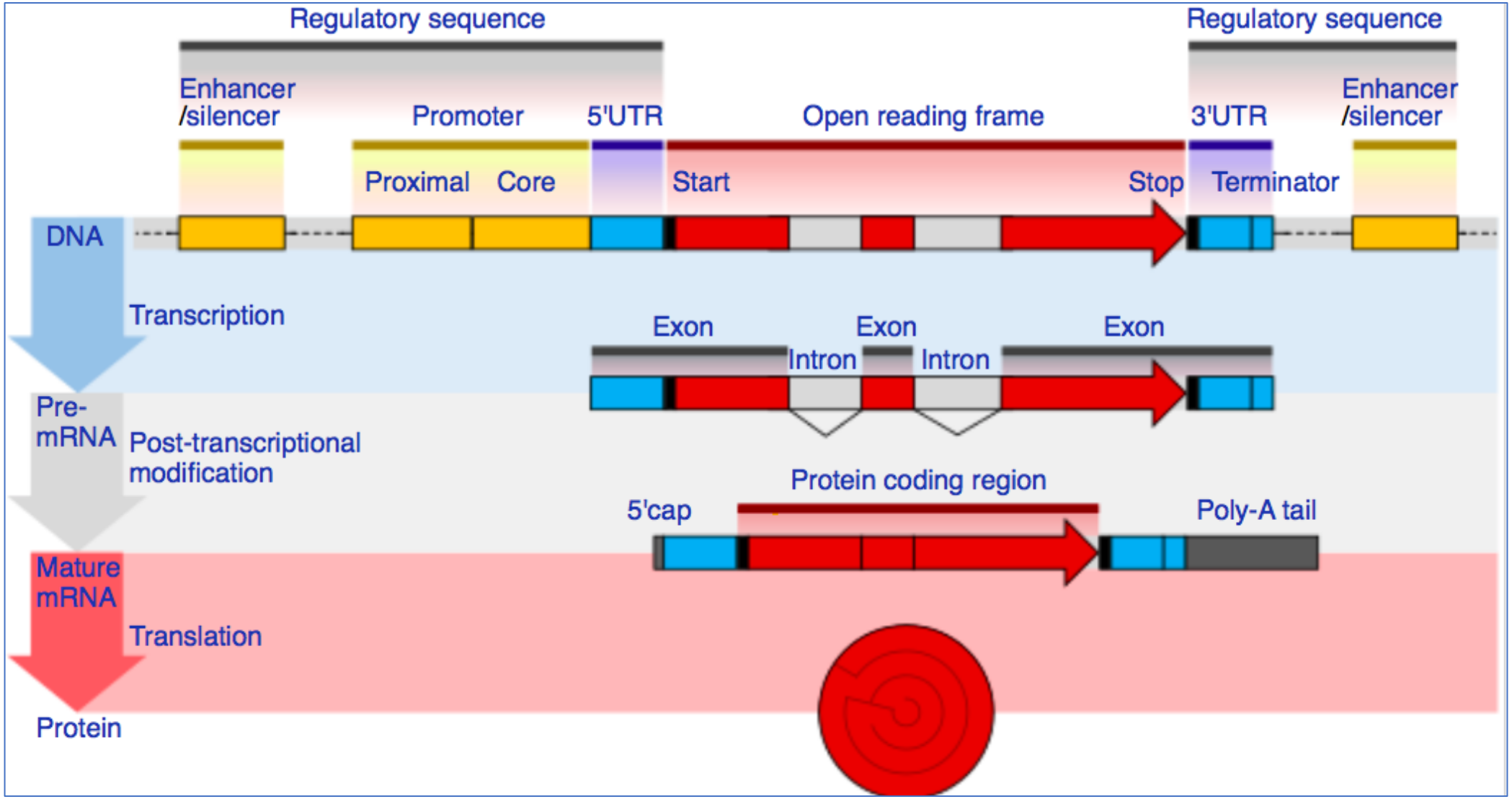
**نوکلئوتید**: ترکیب قند، فسفات و باز آلی

**نوکلئوتید** ترکیبی متشکل از یک قند ۵-کربنی (ریبوز یا دئوکسی ریبوز) اسید فسفریک (فسفات) و یکی از بازهای آلی پورین (آدنین، گوانین) یا پیریمیدین (سیتوزین، تیمین، یوراسیل) است.

اغلب **نوکلئوتید** را نوکلئوزید فسفات می‌گویند.



# Gene Structure in Eukaryotes



# What is bioinformatics?

**Bioinformatics**: word was coined in 1978
**Bio-**: life
**Informatics**: information systems & computer science

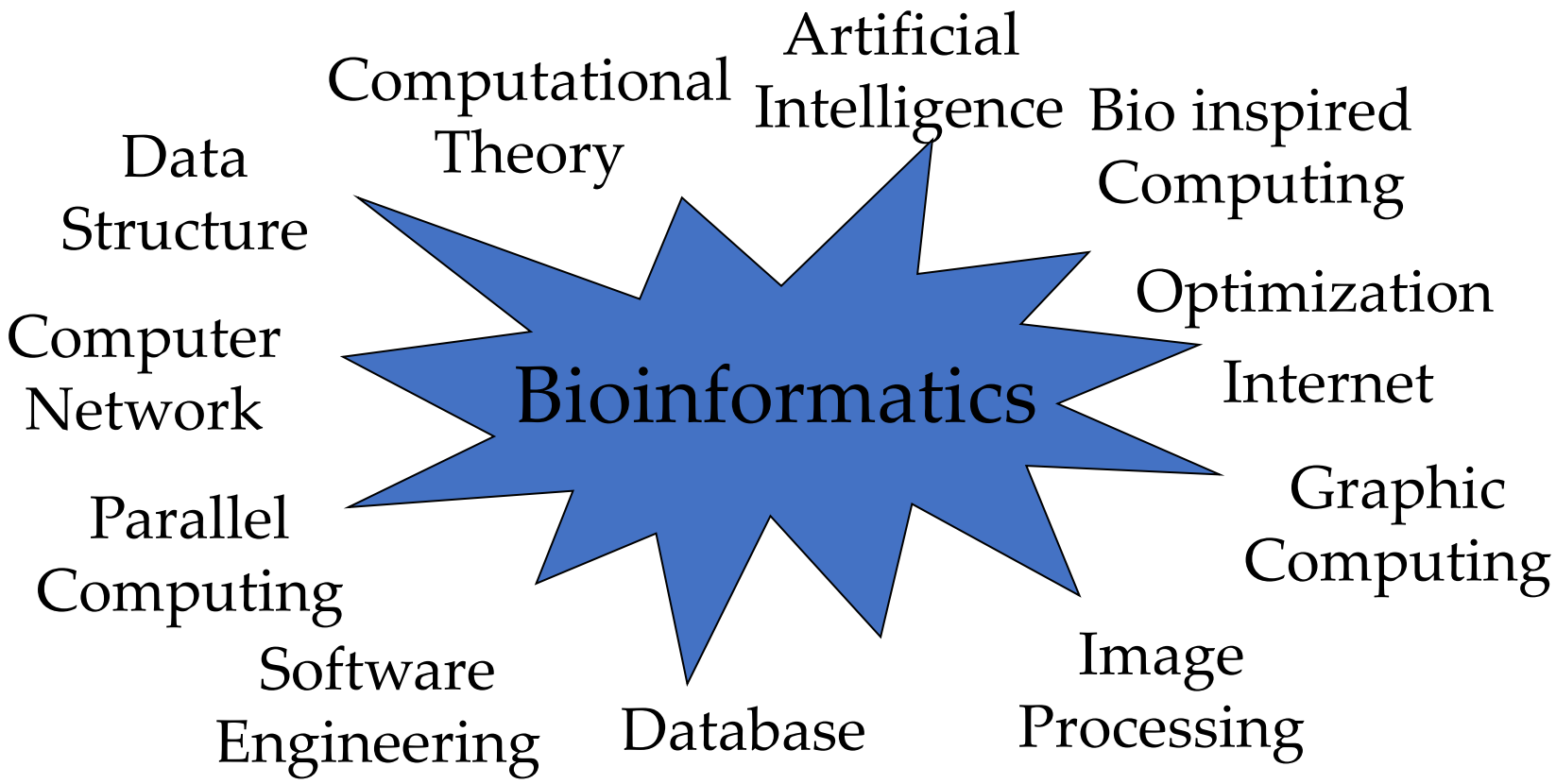
Analysis of **molecular** biology data using techniques from information systems
computer science
artificial intelligence
statistics
mathematics
*~computational biology*
Molecular biology data?


DNA, RNA, genes, proteins…

# Important sub-disciplines within bioinformatics

- **Development of new algorithms and statistics** with which to assess **relationships among members of large data sets**
- **Analysis and interpretation of various types of data** including nucleotide and amino acid sequences, protein domains, and protein structures
- **Development and implementation of tools** that enable efficient access and management of different types of information" (NCBI)"
- All biological computing are not bioinformatics, e.g. mathematical modelling is not bioinformatics, even when connected with biology-related problems

# Bioinformatics

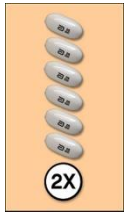


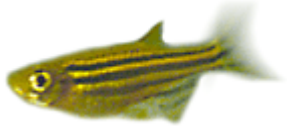
# Aim of bioinformatics

**“To *improve* the quality of life” by understanding how it works**

**Health**

- Disease prevention:
  - Detect people at risk
    - Change of lifestyle, diet…
      - e.g. risk of cardiovascular diseases – exercise…
  - Study virus evolution
    - e.g. bird flu virus
- Treatment:
  - Quantitative evaluation of disease spread
  - Rational drug design
    - e.g. first efficient drug against HIV (Norvir 1996)
  - Gene therapy
    - e.g. “bubble” kids with no immune system
  - Animal model
    - e.g. zebra fish is the new mouse

# Other applications

**Forensic** (DNA fingerprints)

- Criminal suspects (UK: database of 3M people)
- Paternity tests
  Identification of victims (Titanic, earthquakes…)
- Prevent illegal trade (drugs, ivory…)

**Paleoanthropology & archaeology**

- Human evolution
  e.g. where is the first American from?


**Food industry**

- GMOs (Genetically Modified Organisms)
  Famine buster or Frankenfood?

# Big Goal

Discovery of new biological insights

Create a global perspective of living system

Formulate unifying principles in biology

From ‘unknown’ to ‘known’

Fast , efficient way to extract information

# Bioinformatics vs Computational Biology

- Almost interchangeable
- Computational biology may be broader
  - **Computational biology** is an **interdisciplinary field** that applies the **techniques of computer science**, applied **mathematics and statistics** to address **biological problems**
  - Includes bioinformatics

# Impacts of Bioinformatics

- On biological sciences (and medical sciences)
  - Large scale **experimental techniques**
  - **Information growth**
- On computational sciences
  - Biological has become a large source for new **algorithmic and statistical problems**!

# Related Fields

- Proteomics/genomics (metagenomics)/ comparative genomics/structural genomics
- Chemical informatics
- Health informatics/Biomedical informatics
- Complex systems
- Systems biology
- Biophysics
- Mathematical biology
  - tackles biological problems using methods that need not be numerical and need not be implemented in software or hardware

# Home work

- *1 – **Github** Account : Create a Repository Named “ NUS-Assignment “*
- *2 -Upload your CV to “NUS-Assignment”*
- *3 – Share your **LinkedIn** profile in “Readme.md “ on “NUS-Assignment “*

# Thanks