Integrated Access to Biological Data

Budva, 11th of June 2006

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I. Introduction and objectives

To handle biological data repositories by means of semantic and artificial intelligence technologies.

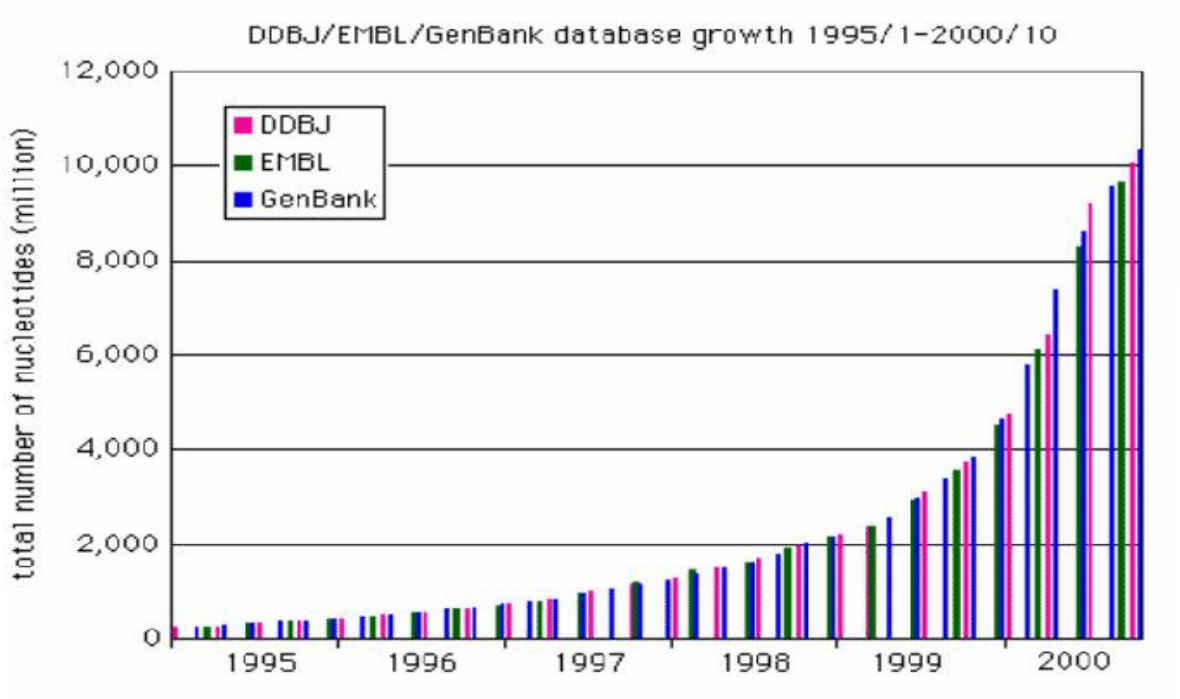
- **Starting point:**
  - **Human genome sequencing has given rise to a great number of biological data repositories.**
- **Problem addressed:**
  - **Quantity and heterogeneity**
- **Our aim:**
  - **To provide an unified access point to diverse biological data repositories.**
- **Our challenge:**
  - **To change the existing vision of ontologies in biology:**
    - **Up to now:** **As mere guides for data structure.**
    - **From now on:** **As integrated modelling of the biological data by combining or associating ontologies.**

II. Biological Data Repositories (i)

Most important categories

- Nucleotides Sequences → DNA
- Amino acid Sequences → Proteins
- Gene expression
- Scientific literature
- Corporate databases
- Health cards

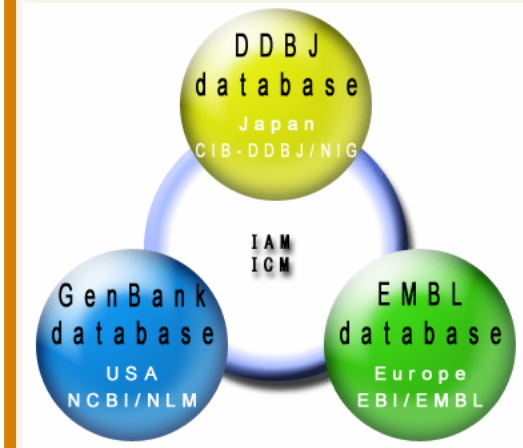
II. Biological Data Repositories (ii)



http://www.math.tau.ac.il/~rshamir/algmb/00/scribe00/html/lec05/node3.html

II. Biological Data Repositories (iii)

THE MOST IMPORTANT DNA DATABASES



DDBJ/EMBL/GenBank
International
Nucleotide Sequence Database

DDBJ: DNA Data Bank of Japan
CIB-DDBJ: Center for Information Biology and DNA Data Bank of Japan
NIG: National Institute of Genetics

EMBL: European Molecular Biology Laboratory
EBI: European Bioinformatics Institute

NCBI: National Center for Biotechnology Information
NLM: National Library of Medicine

IAM: International Advisory Meeting
ICM: International Collaborative Meeting

II. Biological Data Repositories (iv)

- **The most important Protein Databases**
  - **SwissProt**: (http://us.expasy.org/sprot/).
  - **PIR:** Protein Information Resource. (http://pir.georgetown.edu/).
  - **PDB:** Protein Data Bank (http://www.rcsb.org/pdb/).
- **Gene Expression**
  - **GDX**
  - **ExpressDB** (http://arep.med.harvard.edu/ExpressDB).
- **Scientific Literature**
  - **MEDLINE**
  - **PubMed**
  - **UpToDate**

II. Biological Data Repositories (v)

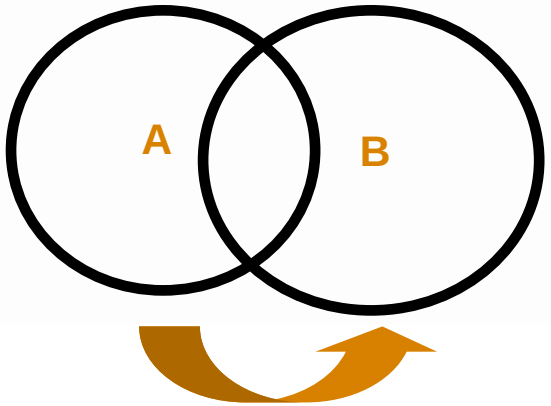
- **Corporate Databases**
- **Health Cards:**
  - **Future Use:**
    - To facilitate the medical care attention
    - To increase patients mobility comfort
    - Administrative tasks
    - Emergency health cards
    - Specific care records
    - Patients general medical records
    - To match genetic patient data with biological databases
  - **Challenges:**
    - To unify the data to store
    - Unification of the media
    - Unification of medical nomenclature

III. Biological ontologies

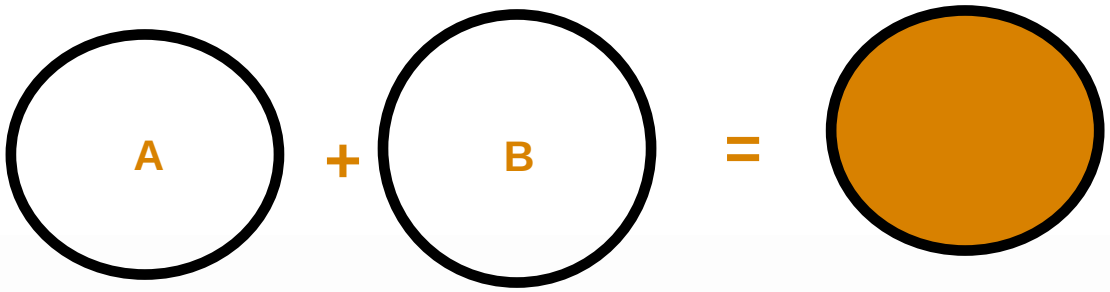
- Gene Ontology
- The Microarray Gene Expression Data (MGED)
- UMLS

IV. Ontology Merging and Mapping

- **Ontology Merging:**

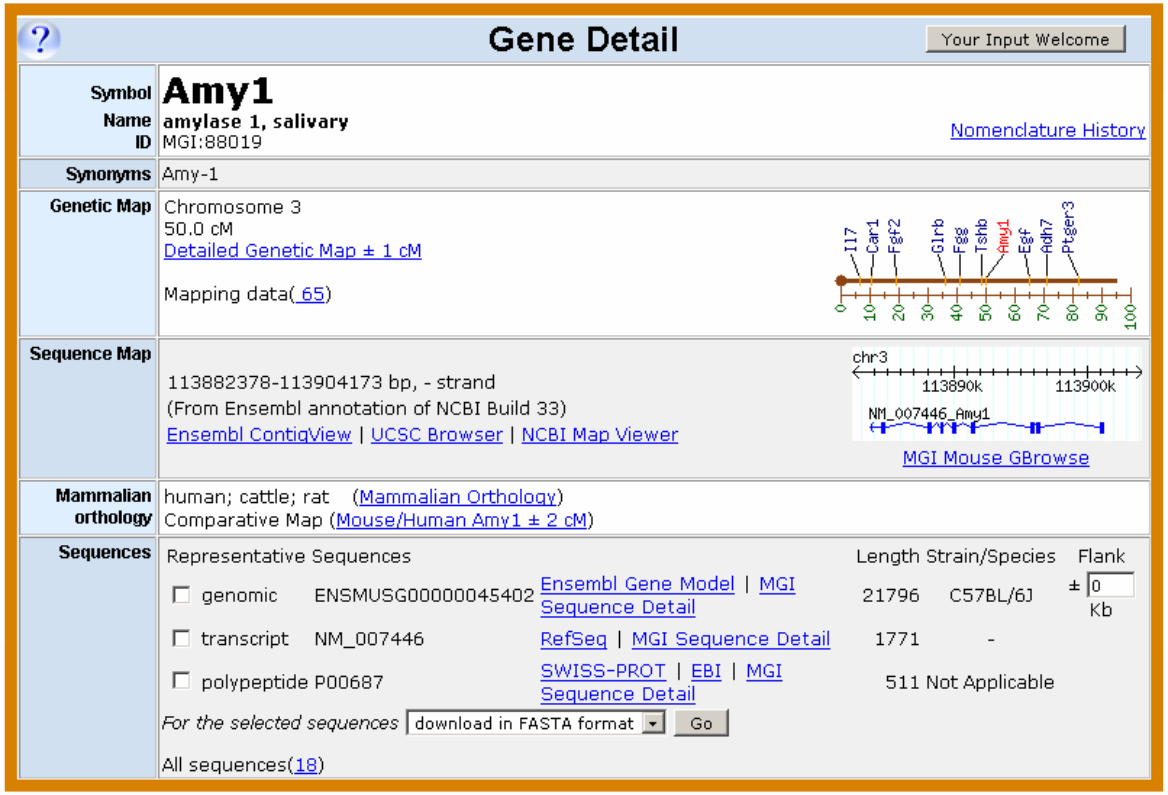


- **Ontology Mapping:**



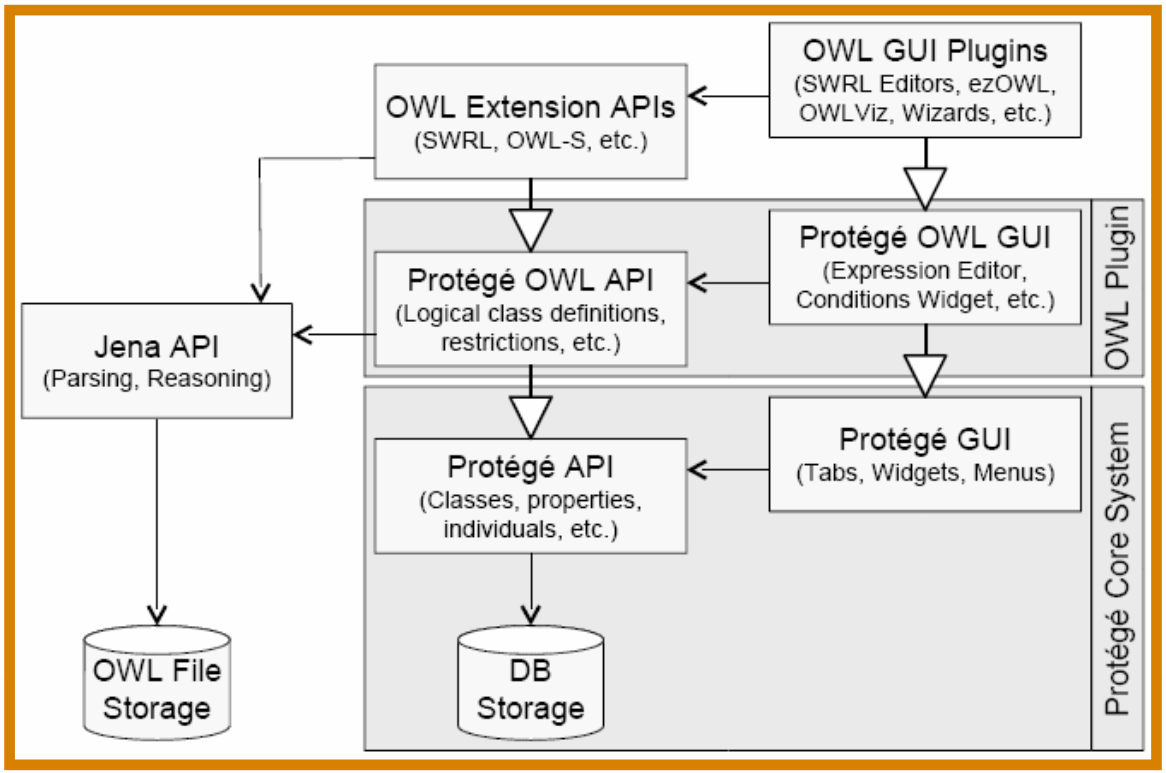
V. Database annotation

Gene ontology annotations



VI. Example of ontology merging/mapping

Protege Archtecture with OWL Plugin

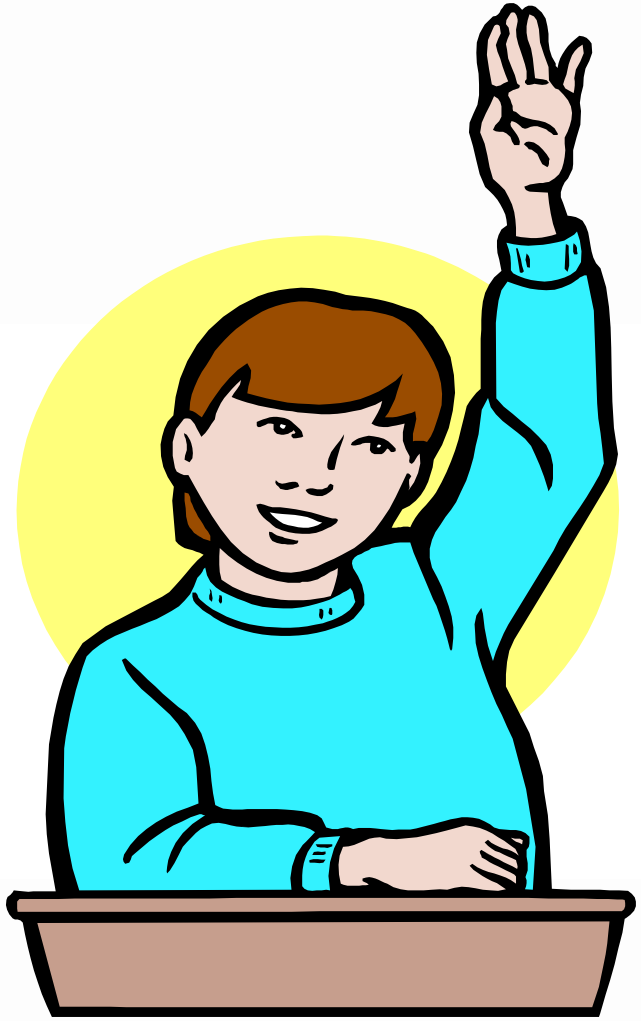


VII. Conclusions

- The application of semantic web technologies to the biological domain is rather limited because:
  - the semantic web technologies
  - the tools needed to implement them

  are still under development.
- Future advances could be applied to solve the immediate scientific needs:
  - Data aggregation and interoperability.
  - Unique entry point for data and processes.
  - Agreement in terminology.
  - Syntax and semantics related to biological data.
  - Semantic data annotation to turn human- understandable data into machine-understandable data.
  - Inference languages to extract and generate knowledge from aggregated data.

VIII. Questions and answers



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