

Computer Applications
for
Biological
and biochemistry
Introduction

“Discovery is to see what everyone else has seen, but think what no one else has thought.”

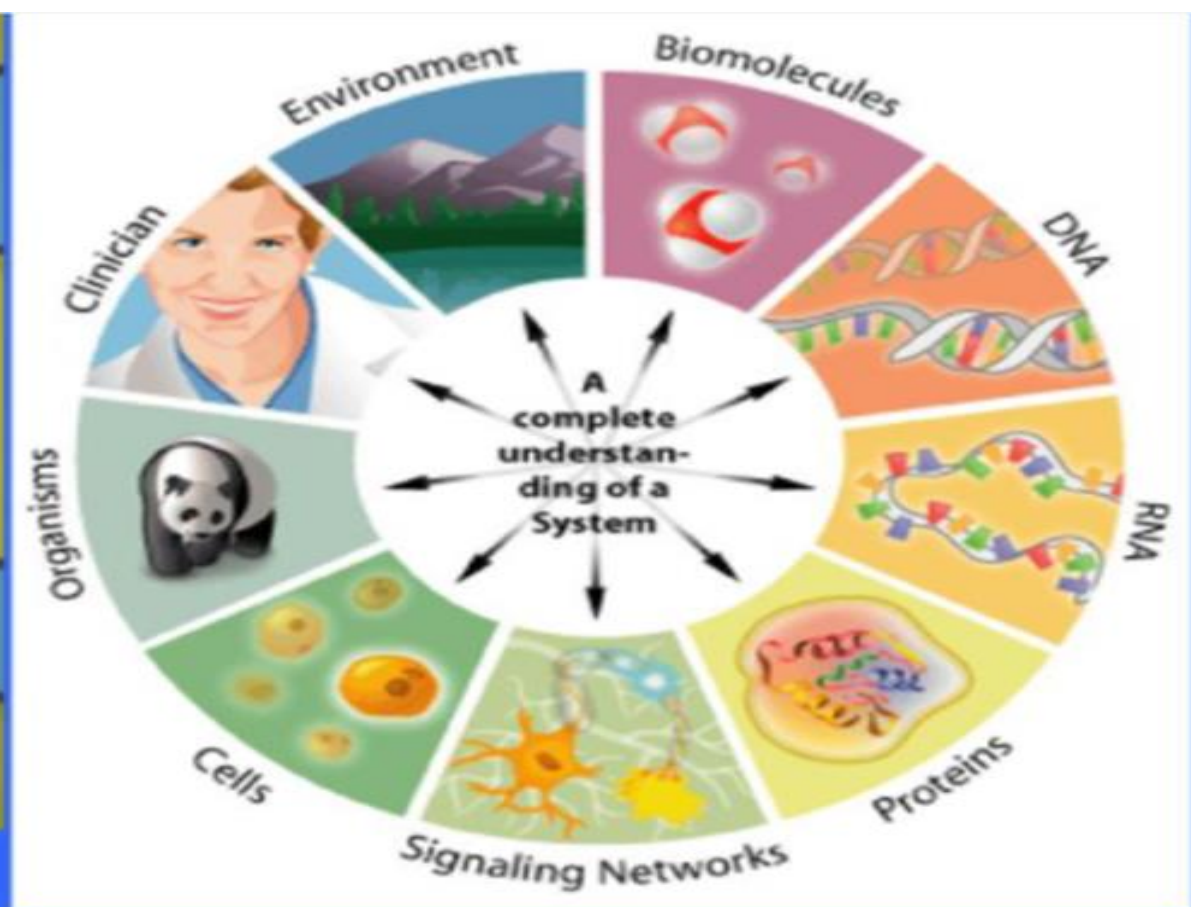
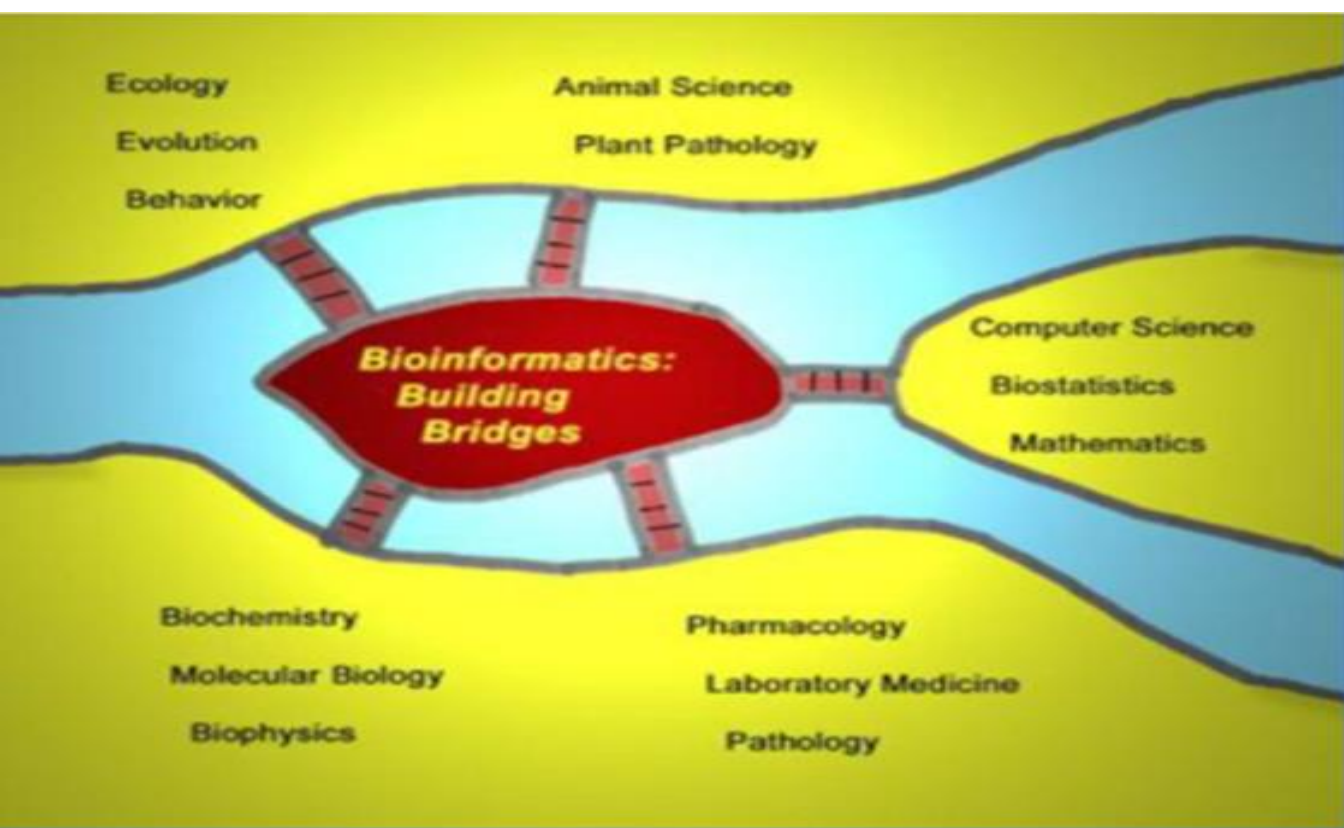
Albert Szent-Györgyi

(The Nobel Prize in Physiology or Medicine, 1937)

“By inventing elegant software tools, we can help biologists see and think.”

“Invention → Discovery”

Kun-Mao Chao



What is Bioinformatics?

The field of science in which **biology**, **computer science** and **information technology** merge into a single discipline

Biologists

collect molecular data:
DNA & Protein sequences,
gene expression, etc.

Bioinformaticians

Study biological questions by
analyzing molecular data

Computer scientists

(+Mathematicians, Statisticians, etc.)
Develop tools, softwares, algorithms
to store and analyze the data.

What can we do with sequences of information?



What is a Database?

A **structured collection** of data held in computer storage; *esp.* one that incorporates software to make it accessible in a variety of ways; *transf.*, any **large collection** of information.

database management: the organization and manipulation of data in a database.

database management system (DBMS): a software package that provides all the functions required for database management.

database system: a database together with a database management system.

What is a database?

- A collection of data
 - structured
 - searchable (index) -> table of contents
 - updated periodically (release) -> new edition
 - cross-referenced (hyperlinks) -> links with other db
- Includes also associated tools (software) necessary for access, updating, information insertion, information deletion....
- Data storage management: flat files, relational databases...

Database: a « relational » example

Relational database (« table file »):

Teacher	Accession number	Education
Amos	1	Biochemistry
Dan	2	Genetics
John	3	Scientology



Course	Year	Involved teachers
Advanced Pottery	2000; 2001	1; 2
Ballet for Fat People	2001; 2002	2; 3

Distribution of sequences

- Books, articles 1968 -> 1985
- Computer tapes 1982 -> 1992
- Floppy disks 1984 -> 1990
- CD-ROM 1989 ->
- FTP 1989 ->
- On-line services 1982 -> 1994
- WWW 1993 ->
- DVD 2001 ->

Google Scholar

<http://www.scholar.google.com/>



The image shows a screenshot of the Google Scholar homepage in a web browser. The browser's address bar shows 'scholar.google.com'. The page features the Google Scholar logo, a search input field with a 'Search' button, and a link to 'Advanced Scholar Search'. Below the search field, there are radio buttons for 'Articles (checked include patents)' and 'Legal opinions and journals'. The slogan 'Stand on the shoulders of giants' is displayed in green. At the bottom, there are links for 'Go to Google Home', 'About Google', and 'About Google Scholar', along with the copyright notice '©2011 Google'.

Google Scholar

scholar.google.com

Web MBE GCS Evol & Bioinfo UKI Mail News Libraries Search Houston Art + Jewelry Orcidids Services + Shopping Fun Musicals Google Ngram Viewer Other Bookmarks

pages Videos Maps News Shopping Gmail more ▾

dgraur@gmail.com | [My Citations](#) | [Scholar Preferences](#) | [My Account](#) | [Sign out](#)

Google
scholar

[Advanced Scholar Search](#)

Articles (include patents) Legal opinions and journals

Stand on the shoulders of giants

[Go to Google Home](#) - [About Google](#) - [About Google Scholar](#)

©2011 Google



What is Google Scholar?

Enables you to search specifically for scholarly literature, including peer-reviewed papers, theses, books, preprints, abstracts and technical reports from all broad areas of research.

orders your search results by how relevant they are to your query, so the most useful references should appear at the top of the page

This relevance ranking takes into account the: full text of each article. the article's author, the publication in which the article appeared and how often it has been cited in scholarly

Scholar

[BOOK] Fundamentals of molecular evolution
WH Li, D **Graur** - 1991 - Sunderland, Mass.: Sinauer Associates
Cited by 372 - [Web Search](#) - [Library Search](#)

[BOOK] Fundamentals of molecular evolution
D **Graur**, WH Li - 2000 - Sunderland, Mass.: Sinauer Associates
Cited by 186 - [Web Search](#) - [Library Search](#)

Patterns of nucleotide substitution in pseudogenes and functional genes

T Gojobori, WH Li, D **Graur** - J. Mol. Evol, 1982 - [ncbi.nlm.nih.gov](#)
Patterns of nucleotide substitution in pseudogenes and functional genes. Gojobori T, Li WH, **Graur** D. MeSH Terms: Base Sequence; Codon; DNA/genetics*; Evolution* ...
Cited by 116 - [Web Search](#)

[CITATION] Extent of protein polymorphism and the neutral mutation theory

M Nei, D **Graur** - Evol. Biol, 1984
Cited by 86 - [Web Search](#)

Is the guinea-pig a rodent?

D **Graur**, WA Hide, WH Li - Nature, 1991 - [ncbi.nlm.nih.gov](#)
The guinea-pig (Cavia porcellus), traditionally classified as a New World hystricomorph rodent, often shows anomalous morphological and molecular ...
Cited by 86 - [Web Search](#)

Phylogenetic position of the order Lagomorpha(rabbits, hares and allies)

D **Graur**, L Duret, M Gouy - Nature, 1996 - [ncbi.nlm.nih.gov](#)
Ever since they have been classified as ruminants in the Old Testament (Leviticus 11:6, Deuteronomy 14:7) and equated with hyraxes in the vulgate ...
Cited by 78 - [Web Search](#)

Web of science

http://http://apps.webofknowledge.com.ezproxy.lib.uh.edu/WOS_GeneralSearch_input.do?product=WOS&search_mode=GeneralSearch&SID=4FB7LbbLgDMhG9fDiLh&preferencesSaved=

WEB OF KNOWLEDGE™ | DISCOVERY STARTS HERE

THOMSON REUTERS

Go to mobile site

Sign In

Marked List (0)

My Endnote Web

My ResearcherID

My Citation Alerts

My Saved Searches

Log Out

Help

All Databases | Select a Database | Web of Science | Additional Resources

Search | Author Finder | Cited Reference Search | Advanced Search | Search History

Web of Science™

Search

Example: oil spill* mediterranean

in

AND

Example: O'Brian C* OR O'Brian C*

Need help finding papers by an author? Use [Author Finder](#).

in

AND

Example: Cancer* OR Journal of Cancer Research and Clinical Oncology

in

[Add Another Field >>](#)

Search

Clear

Searches must be in English

Current Limits: (To save these permanently, [sign in or register](#).)

⊞ Timespan

All Years (updated 2011-08-21)

From to (default is all years)

⊞ Citation Databases: Science Citation Index Expanded (SCI-EXPANDED); Social Sciences Citation Index (SSCI); Arts & Humanities Citation Index (A&HCI); Conference Proceedings Citation Index- Science (CPCI-S); Conference Proceedings Citation Index- Social Science & Humanities (CPCI-SSH)

⊞ Adjust your search settings

⊞ Adjust your results settings

View in: [简体中文](#) | [English](#) | [日本語](#)

University of Houston



Maintenance Alert

We understand that you may have questions about differences you may be noting between the new Web of Knowledge and the previous version. Please take a look at our [Frequently Asked Questions](#) page for more information.

Support, Tools, Tips

Training & Support

- Download quick Recorded Training
- Access additional Training Resources
- More questions? Consult the [Help files](#)



What's new in Web of Knowledge?

- ResearcherID is now searchable from within Web of Science™.
- Automatic spelling variations and all new Author Finder in Web of Science™.
- [More of What's New](#)

[Access the [previous version of Web of Knowledge](#)]

Featured Tips

- Get a complete view of citation activity ([view demo](#)).
- Identify citation trends graphically with Citation Report ([view demo](#)).

Web of ScienceSM[<< Back to previous page](#)**Cited Reference Search** (Find the articles that cite a person's work)[View our Cited Reference Search tutorial.](#)**Step 2:** Select cited references and click "Finish Search."

Hint: Look for cited reference variants (sometimes different pages of the same article are cited or papers are cited incorrectly).

CITED REFERENCE INDEX

References: 1 - 50 of 193

Page 1 of 4 [Go](#)[Select Page](#)[Select All*](#)[Clear All](#)[Finish Search](#)

Select References	Cited Author	Cited Work [SHOW EXPANDED TITLES]	Year	Volume	Page	Article ID	Citing Articles **	View Record
<input type="checkbox"/>	Abulafia, S., Graur, D.	ISRAEL J PLANT SCI	1996	44	77		1	View Record
<input type="checkbox"/>	Amon, A., Graur, D.	J MOL BIOL	2001	307	447	10.1006/jmbi.2000.4474	198	View Record
<input type="checkbox"/>	Amason, U., Graur, D.	J MOL EVOL	1996	43	41	10.1007/BF02352298	21	View Record
<input type="checkbox"/>	Bark, Y., Graur, D.	MAR BIOL	2000	136	37	10.1007/s002279050005	13	View Record
<input type="checkbox"/>	Bark, Y., Graur, D.	MAR ECOL-PROG SER	2002	231	91	10.3354/meps231091	17	View Record
<input type="checkbox"/>	Ben-Dor, A., Graur, D.	J COMPUT BIOL	1998	5	377	10.1089/cmb.1998.5.377	21	View Record
<input type="checkbox"/>	BREIMAN, A., GRAUR, D.	THEOR APPL GENET	1991	82	201		9	View Record
<input type="checkbox"/>	BREIMAN, A., GRAUR, D.	ISRAEL J PLANT SCI	1995	43	85		10	View Record
<input type="checkbox"/>	Cohen, N., Graur, D.	MOL BIOL EVOL	2005	22	1260	10.1093/molbev/msl115	37	View Record
<input type="checkbox"/>	Crozier, R. H., Graur, D.	MOL PHYLOGENET EVOL	1995	4	20	10.1006/impv.1995.1003	29	View Record
<input type="checkbox"/>	Dagan, T., Graur, D.	MOL BIOL EVOL	2005	23	310	10.1093/molbev/msj036	28	View Record
<input type="checkbox"/>	Dagan, T., Graur, D.	MOL BIOL EVOL	2005	22	496		9	View Record
<input type="checkbox"/>	Dagan, T., Graur, D.	MOL BIOL EVOL	2002	19	1022		29	View Record
<input type="checkbox"/>	Dagan, T., Graur, D.	NUCLEIC ACIDS RES	2004	32	D489	10.1093/nar/gkh132	36	View Record
<input type="checkbox"/>	Elhaik, Eran., Graur, Dan	BIOL DIRECT	2010	5		ARTN 10	1	View Record
<input type="checkbox"/>	Elhaik, Eran., Graur, Dan	COMPUT BIOL CHEM	2008	32	147	10.1016/j.complbiolchem.2007.11.003	4	View Record
<input type="checkbox"/>	Elhaik, Eran., Graur, Dan	MOL BIOL EVOL	2010	27	1015	10.1093/molbev/msp307	2	View Record
<input type="checkbox"/>	Elhaik, Eran., Graur, Dan	MOL BIOL EVOL	2009	26	1829	10.1093/molbev/msp100	6	View Record
<input type="checkbox"/>	Elhaik, E., Graur, D.	MOL BIOL EVOL	2006	23	1	10.1093/molbev/msj006	17	View Record



How To Register And Use The Egyptian Knowledge Bank

ONLINE WORKSHOP

Every Monday and Thursday at 9:00 pm FOR RESEARCHERS AND GENERAL READERS
[Join Now](#)

1 EKB Online Workshops

2 Study Material for all School Grades

3 EKB Search Engine Your Best Academic Companion

4 Ongoing: Research Activities and Services

51% 1.8K/s 0.7K/s



Try Our Academic Search Engine

The best companion to your studies



[Advanced Search >](#)

1 EKB Search Engine Your Best Academic Companion

2 Getting Started: Watch Orientation Tutorial Video

3 New Egyptian sauropod

4 Ongoing: Research Activities and Services

50% 1.4K/s 3.8K/s







