Chapter 3. DNA Databases

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PPT slides and Message @ http://jxpt.fafu.edu.cn/meol/homepage/common/

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OUTLINES

Lecture 3.1 DNA Sequence Databases

1. DNA databases
2. GenBank overview

Lecture 3.2 Introduction to NCBI's query strategy

1. Database Query Tools
2. Query in NCBI

Lecture 3.1 DNA Sequence Databases

1. DNA databases

1.1 Primary sequence repositories:

❶ International Nucleotide Sequence Database Collaboration

GenBank (NCBI, USA), EMBL (European Molecular Biology Laboratory), DDBJ (DNA Data Bank of Japan).

❷ Daily data exchange and mirroring

❸ Sequences submitted to one become available in all.

❹ Current holdings: 217,971,437,647 bases, 196,120,831 sequences in GenBank.

→ Very high level of redundancy

1.2 Other sequence repositories

- BIOSINO- (www.biosino.org, Chinese)
- dbEST - Database of Expressed Sequence Tags (NCBI)
- dbSTS - Database of Sequence Tagged Sites (NCBI)

1.3 Genomic Databases

- **GenomeWeb (HGMP)** - A catalogue of useful Web sites for Genomics with a set of collections of genome databases
- **NCGR** – National Center for Genome Research (www.ncgr.org)
- **GOLD** - Genomes On-line db (https://gold.jgi.doe.gov/)

1.4 DNA 3D Databases

- **NDB** - Nucleic Acid Databank (3D structures)
- **BNASDB** - Nucleic acid structure db from University of Pune

1.5 Others

- ✓ AsDb - Aberrant Splicing db
- ✓ ACUTS - Ancient conserved untranslated DNA sequences db
- ✓ Codon Usage Db - The frequency of codon use in each organism is made searchable through this World Wide Web site.

- ✓ EPD - Eukaryotic Promoter db
- ✓ PLACE - Plant cis-acting regulatory DNA elements db
- ✓ HOVERGEN - Homologous Vertebrate Genes db
- ✓ IMGT - ImMunoGeneTics db [Mirror at EBI]
- ✓ ISIS - Intron Sequence and Information System
- ✓ RDP - Ribosomal db Project
- ✓ gRNAs db - Guide RNA db

- ✓ RNA editing - RNA editing site
- ✓ RNAmod db - RNA modification db
- ✓ TelDB - Multimedia Telomere Resource
- ✓ TRADAT - TRAnscription Databases and Analysis Tools
- ✓ Subviral RNA db - Small circular RNAs db (viroid and viroid-like)

2. GenBank Overview

(www.ncbi.nlm.nih.gov)

❶ Corenucleotide: From whole genome to single gene sequences.

❷ Genomic database

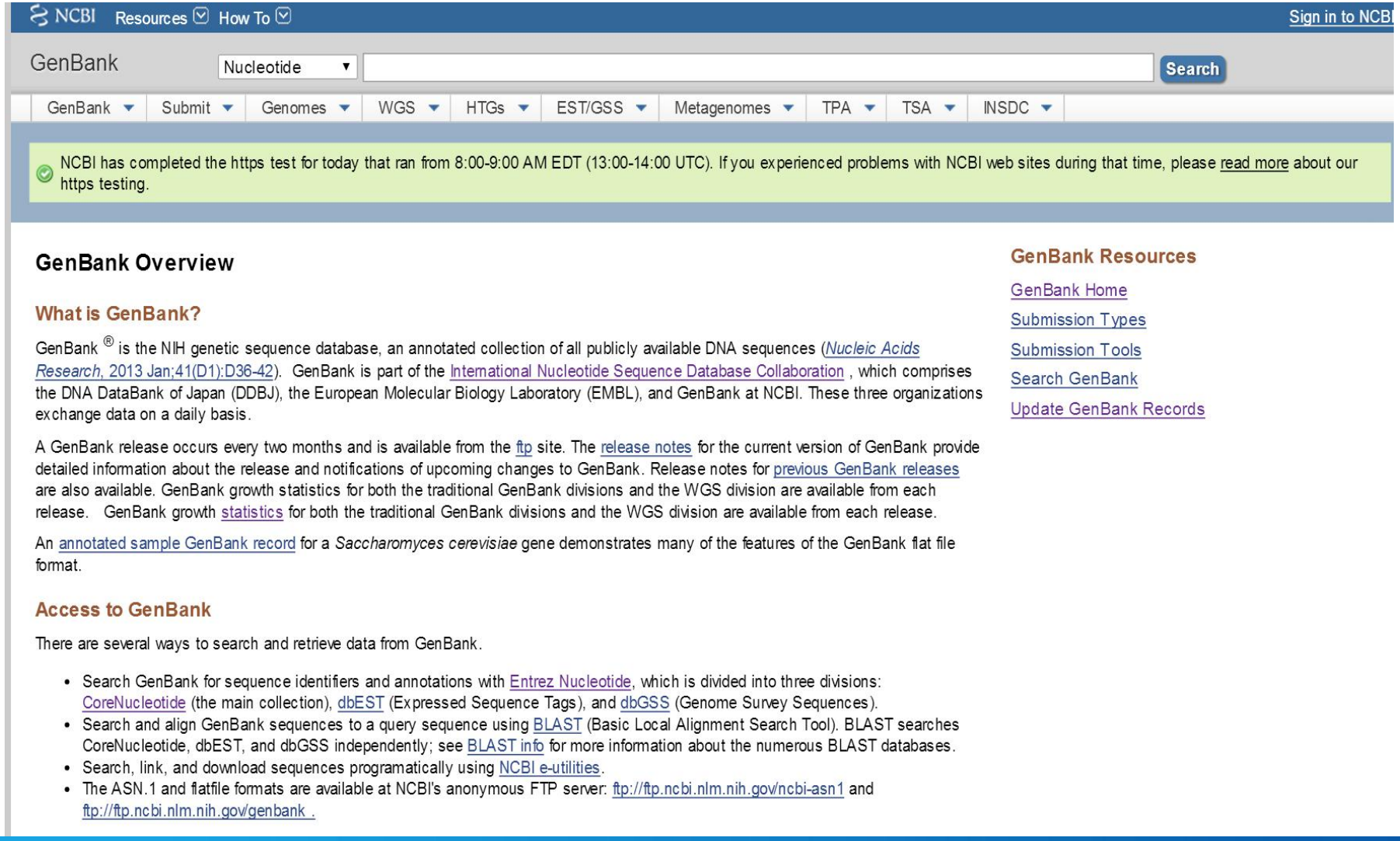
- *Saccharomyces cerevisiae* 酵母
- *Caenorhabditis elegans* 线虫

- *Drosophila melanogaster* 果蝇
- Arabidopsis thaliana 拟南芥
- *Helicobacter pylori* 幽门螺旋杆菌

❸ dbEST (Expressed Sequence Tags)

❹ dbGSS (Genome Survey Sequences)

http://www.ncbi.nlm.nih.gov/genbank/



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NCBI's contribution to the NIH mission of 'uncovering new knowledge'

Organizational Structure

The role of the branches within NCBI and the Board of Scientific Counselors.

Programs & Activities

NCBI's resources for genomic, genetic, and biomedical data

Researchers at NCBI

The basic research program conducted by our intramural investigators

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NCBI News

Leiden Open Variation Database to be retired September 30, 2016

Thursday, September 8, 2016

New on NCBI Insights: Find, Browse and Follow Biomedical Literature with PubMed Journals

Wednesday, September 7, 2016

September 7th webinar: The E-Utilities in an Age without GI Numbers

Thursday, September 1, 2016

October 24-26: Hackathon at Cold Spring Harbor Laboratory

NCBI Home
Resource List (A-Z)
All Resources
Chemicals & Bioassays
Data & Software
DNA & RNA
Domains & Structures
Genes & Expression
Genetics & Medicine
Genomes & Maps
Homology
Literature
Proteins
Sequence Analysis
Taxonomy
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Variation
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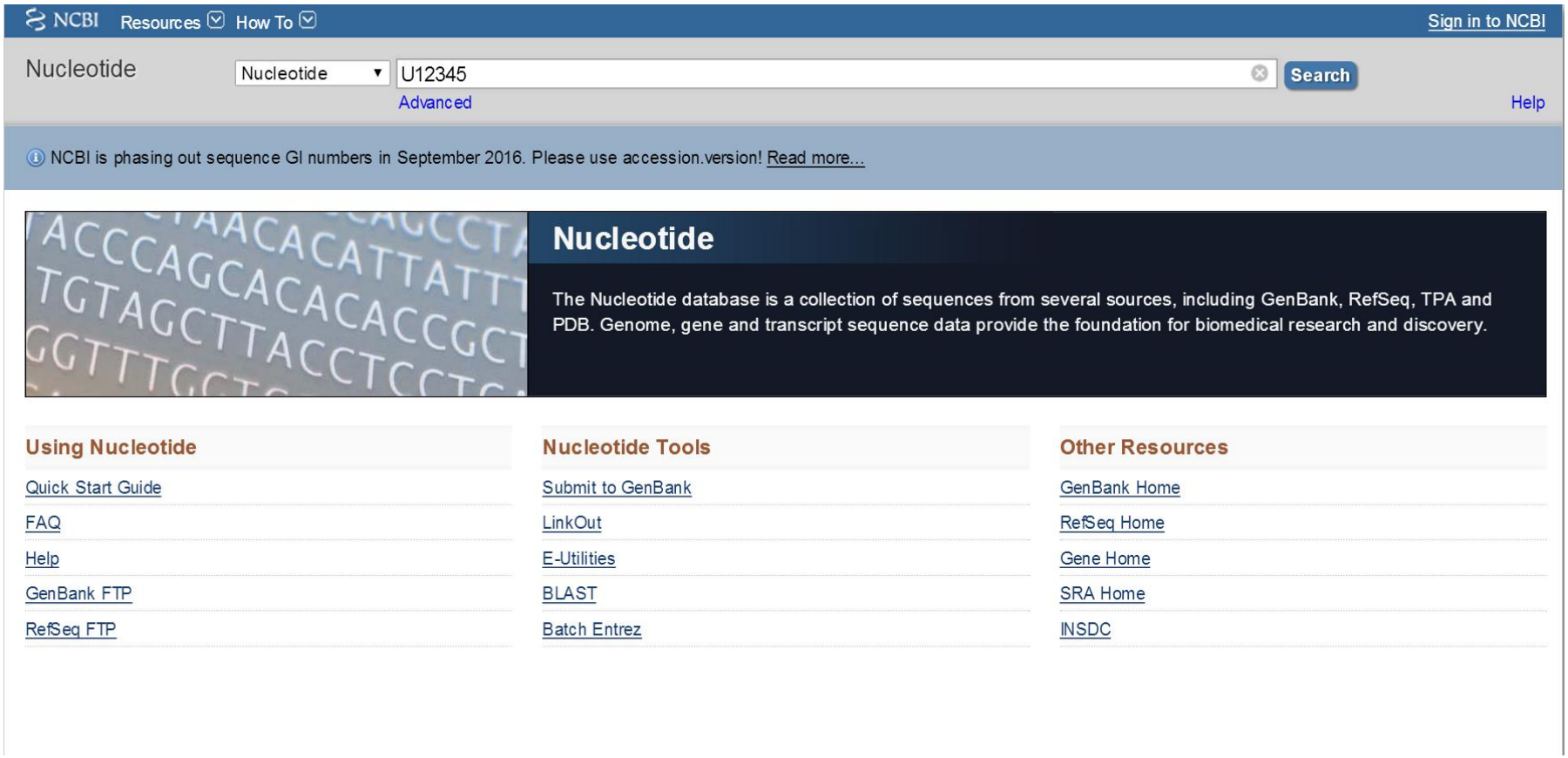
Genome
SNP
Gene
Protein
PubChem
NCBI Announcements
Genomes FTP site update (version 1.3) adds new data formats and more
14 Sep 2016
NCBI has released a comprehensive
RefSeq release 78 is now available
12 Sep 2016


NCBI Resources How To
Sign in to NCBI
Nucleotide
Nucleotide
U12345
Search
Advanced
Help
NCBI is phasing out sequence GI numbers in September 2016. Please use accession.version! Read more...
Nucleotide
The Nucleotide database is a collection of sequences from several sources, including GenBank, RefSeq, TPA and PDB. Genome, gene and transcript sequence data provide the foundation for biomedical research and discovery.
Using Nucleotide
Quick Start Guide
FAQ
Help
GenBank FTP
RefSeq FTP
Nucleotide Tools
Submit to GenBank
LinkOut
E-Utilities
BLAST
Batch Entrez
Other Resources
GenBank Home
RefSeq Home
Gene Home
SRA Home
INSDC

NCBI Resources How To

Nucleotide Nucleotide Advanced

NCBI is phasing out sequence GI numbers in September 2016. Please use accession.version! Read more...

GenBank Send to:

Aepyceros melampus isolate am5 D-loop, partial sequence; mitochondrial

GenBank: U12345.1

FASTA Graphics

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LOCUS       AMU12345                426 bp    DNA     linear   MAM 21-SEP-2007
DEFINITION  Aepyceros melampus isolate am5 D-loop, partial sequence;
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ACCESSION   U12345
VERSION     U12345.1  GI:540023
KEYWORDS    .
SOURCE      mitochondrion Aepyceros melampus (impala)
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REFERENCE   1  (bases 1 to 426)
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  TITLE     Population genetics of Kenyan impalas - consequences for
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  JOURNAL   (in) Wayne,R.K. and Smith,T.B. (Eds.);
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            Oxford University Press, Oxford, U.K. (1996)
REFERENCE   2  (bases 1 to 426)
  AUTHORS   Arctander,P.
  TITLE     Direct Submission
  JOURNAL   Submitted (14-JUL-1994) Peter Arctander, Population Biology,
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            15, Copenhagen, DK-2100 O, Denmark
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                     /note="control region"
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      301 ctcaagcata taagcaagta ctagacattc actagcggta catagtacat ttcattgttc
      361 atcgtacata gcgcatgtca gncaaatccg ttcttgtcaa catgcatatc ccgtccacta
      421 gatcac
//
```

Sequence Formats

- FASTA

  --Very simple “sequence only” format

  --Specification:

  1. Start sequence entry with “>” on a new line
  2. Provide sequence on next lines in single character code

- Example:

  >gi|14286176|sp|P00528|SRC1_DROME Tyrosine-protein kinase Src64B

MGNKCCSKRQDQELALAYPTGGYKKSDYTFGQTHINSSGGGNMGGVLG
QKHNNGGSLDSRYTPDPNHRGPLKIGGKGGVDIIRPRTTPTGVPGVVLKR
VVVALYDYKSRDESDLSFMKGDRMEVIDDTESDWWRVVNLTTRQEGLIP
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TAPEAIIYGKFSIKSDVWSYGILLMELFTYGQVPYPGHSREVIENIERGFRM
PKPTNHYFPDNIYQLLLQCWDAVPEKRPTFEFLNHYFESFSVTSEVPYRE
VQD

- Full entry format

  --Complete information for a particular entry

  --Very annotation rich

  --Many cross-links on WWW

  --Varies between databases

  --Most commonly used: GenBank & Swiss-Prot

- Example: P00519

Lecture 3.2 Introduction to NCBI's query strategy

OUTLINES

1. Database Query Tools
2. Query in NCBI

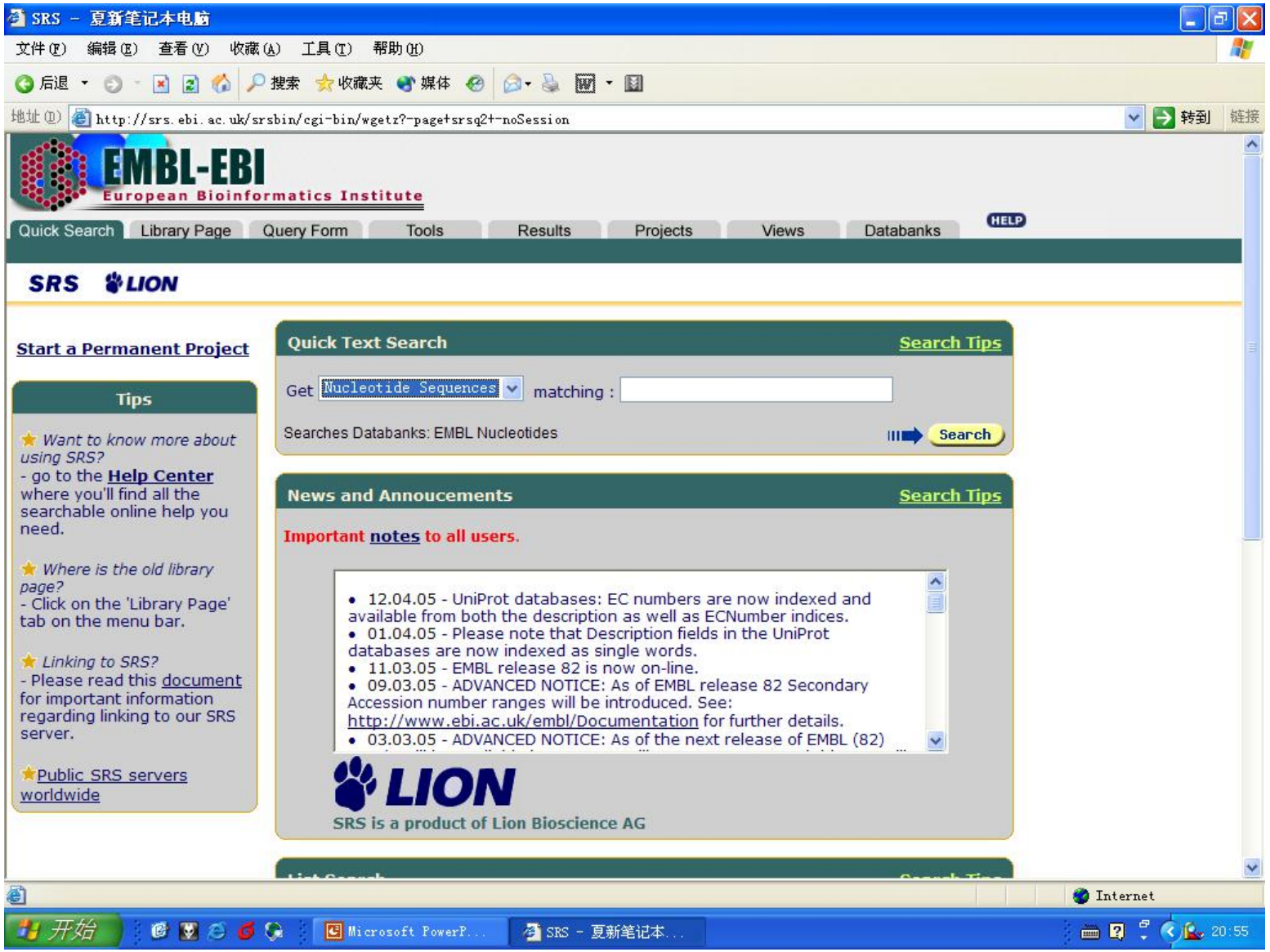
1. Database Query Tools

1.1 SRS (Sequence Retrieval System)

- EMBL, LION Bioscience
- Open query system, more than 300 databases in SRS severs.

- LION Bioscience Website http://www.lionbio.co.uk/publicsrs.html

- http://srs6.ebi.ac.uk/srs6/
- http://iron.hgmp.mrc.ac.uk/srs6/
- http://www.sanger.ac.uk/srs6/
- http://www.infobiogen.fr/srs6/
- http://www.cmbi.kun.nl/srs6
- http://srs.wehi.edu.au/srs6/
- http://genius.embnet.dkfz-heidelberg.de/menu/srs/
- http://www.cbr.nrc.ca/srs6/
- http://srs.pku.edu.cn/srs6bin/cgi-bin/wgetz


SRS - 夏新笔记本电脑
文件(F) 编辑(E) 查看(V) 收藏(A) 工具(T) 帮助(H)
后退 搜索 收藏夹 媒体
地址(D) http://srs.ebi.ac.uk/srsbin/cgi-bin/wgetz?-page+srsq2+-noSession
转到 链接
EMBL-EBI
European Bioinformatics Institute
Quick Search Library Page Query Form Tools Results Projects Views Databanks HELP
SRS LION
Start a Permanent Project
Tips
Want to know more about using SRS?
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Where is the old library page?
- Click on the 'Library Page' tab on the menu bar.
Linking to SRS?
- Please read this document for important information regarding linking to our SRS server.
Public SRS servers worldwide
Quick Text Search
Search Tips
Get Nucleotide Sequences matching :
Searches Databanks: EMBL Nucleotides
Search
News and Annoucements
Search Tips
Important notes to all users.
• 12.04.05 - UniProt databases: EC numbers are now indexed and available from both the description as well as ECNumber indices.
• 01.04.05 - Please note that Description fields in the UniProt databases are now indexed as single words.
• 11.03.05 - EMBL release 82 is now on-line.
• 09.03.05 - ADVANCED NOTICE: As of EMBL release 82 Secondary Accession number ranges will be introduced. See: http://www.ebi.ac.uk/embl/Documentation for further details.
• 03.03.05 - ADVANCED NOTICE: As of the next release of EMBL (82)
LION
SRS is a product of Lion Bioscience AG
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开始
Microsoft PowerP...
SRS - 夏新笔记本...
20:55

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后退 搜索 收藏夹 媒体
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European Bioinformatics Institute
Quick Search Library Page Query Form Tools Results Projects Views Databanks HELP
Text Entry | SwissEntry | NiceProt | iProClass | UniProtXML
Reset
Entry 1 of 2 from Query 1 Next Entry
Entry Information
Entry from: UniProt
Entry Options
Launch analysis tool:
BlastP
Launch
Link to related information:
Link
Save entry: Save
View:
Printer Friendly
General Description References Comments Links Keywords Features Sequence
General information
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Accession number P12345
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Sequence update Rel. 12, 1-OCT-1989
Annotation update Rel. 44, 5-JUL-2004
Description and origin of the Protein
Description Aspartate aminotransferase, mitochondrial (EC 2.6.1.1) (Transaminase A) (Glutamate oxaloacetate transamir
Gene name(s) GOT2
Organism source Oryctolagus cuniculus (Rabbit).
Taxonomy Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi; Mammalia; Eutheria; Euarchontoglires; G
Leporidae; Oryctolagus.
NCBI TaxID 9986
References
[1] Kuramitsu,S., Inoue,K., Kondo,K., Aki,K., Kagamiyama,H.,
Aspartate aminotransferase isozymes from rabbit liver. Purification and properties.
(1985) J. Biochem. 97:1337-1345
完毕
Internet
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Microsoft PowerP...
Entry Page - 夏...
20:57

1.2 Query in NCBI

http://www.ncbi.nlm.nih.gov/Entrez

- Overview:
  - -- Database structure
  - -- Basic Searching
  - -- Using related links/neighbors
  - -- Details, Limits, Preview ….
  - -- Entrez field qualifiers
  - -- Advanced Boolean queries
  - **-- Practical examples and hands-on work!**

NCBI databases

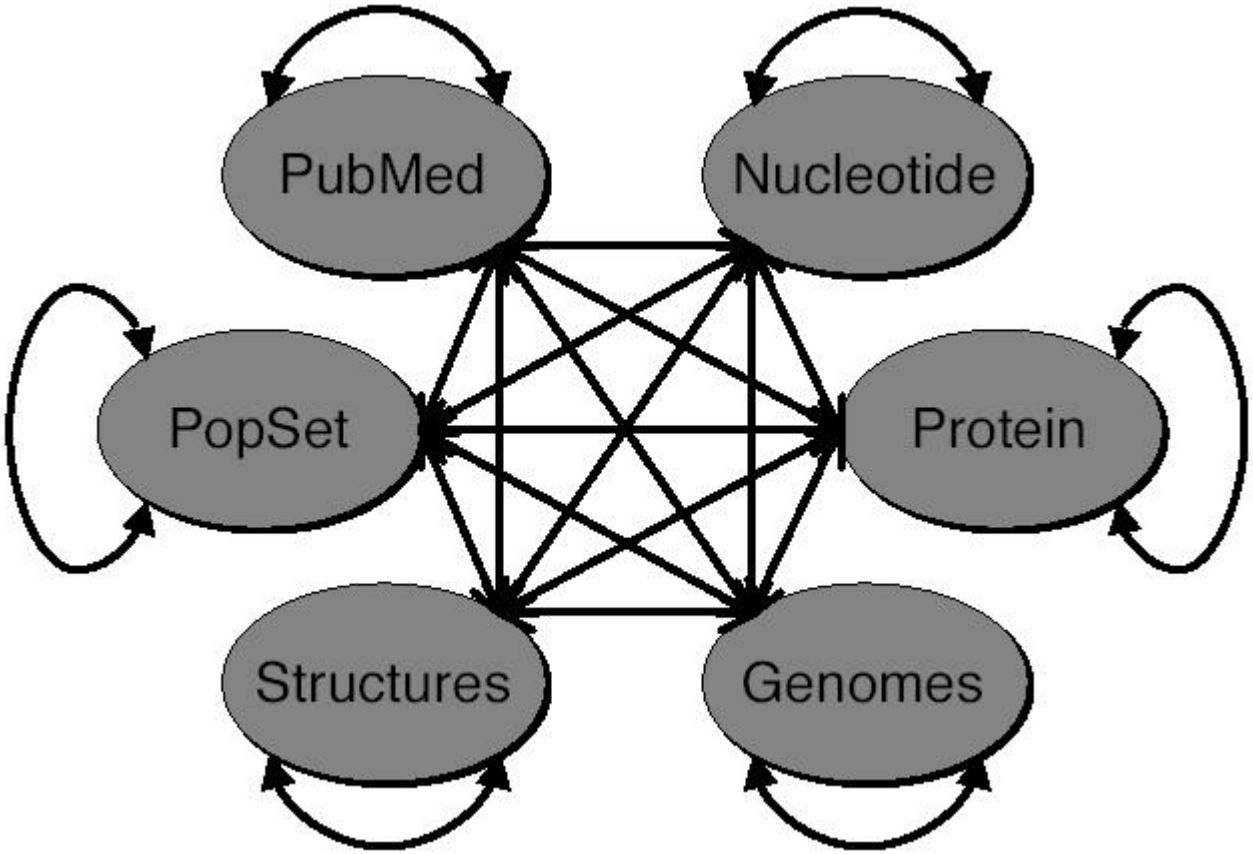
NCBI integrated databases include:

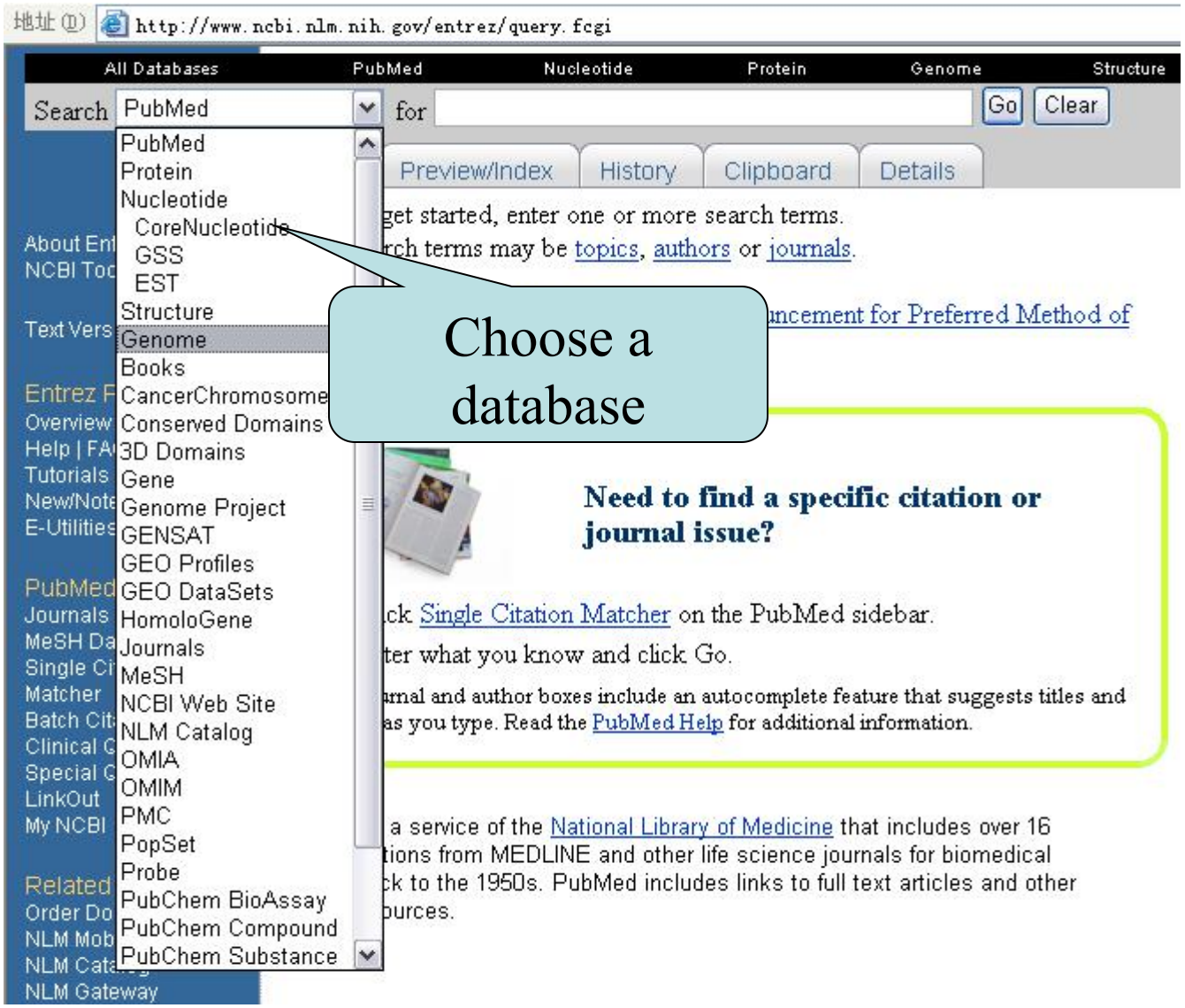
- PubMed: The biomedical literature (PubMed)
- Nucleotide sequence database (Genbank)
- Protein sequence database
- Structure: three-dimensional macromolecular structures
- Genome: complete genome assemblies
- PopSet: population study data sets
- OMIM: Online Mendelian Inheritance in Man

NCBI databases

- Taxonomy: organisms in GenBank
- Books: online books
- ProbeSet: gene expression and microarray datasets
- 3D Domains: domains from Entrez Structure
- UniSTS: markers and mapping data
- SNP: single nucleotide polymorphisms
- CDD: conserved domains

Entrez database connection




http://www.ncbi.nlm.nih.gov/entrez/query.fcgi
All Databases
PubMed
Nucleotide
Protein
Genome
Structure
Search
PubMed
for
Go
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Preview/Index
History
Clipboard
Details
PubMed
Protein
Nucleotide
CoreNucleotide
GSS
EST
Structure
Genome
Books
CancerChromosome
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3D Domains
Gene
Genome Project
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PubChem Compound
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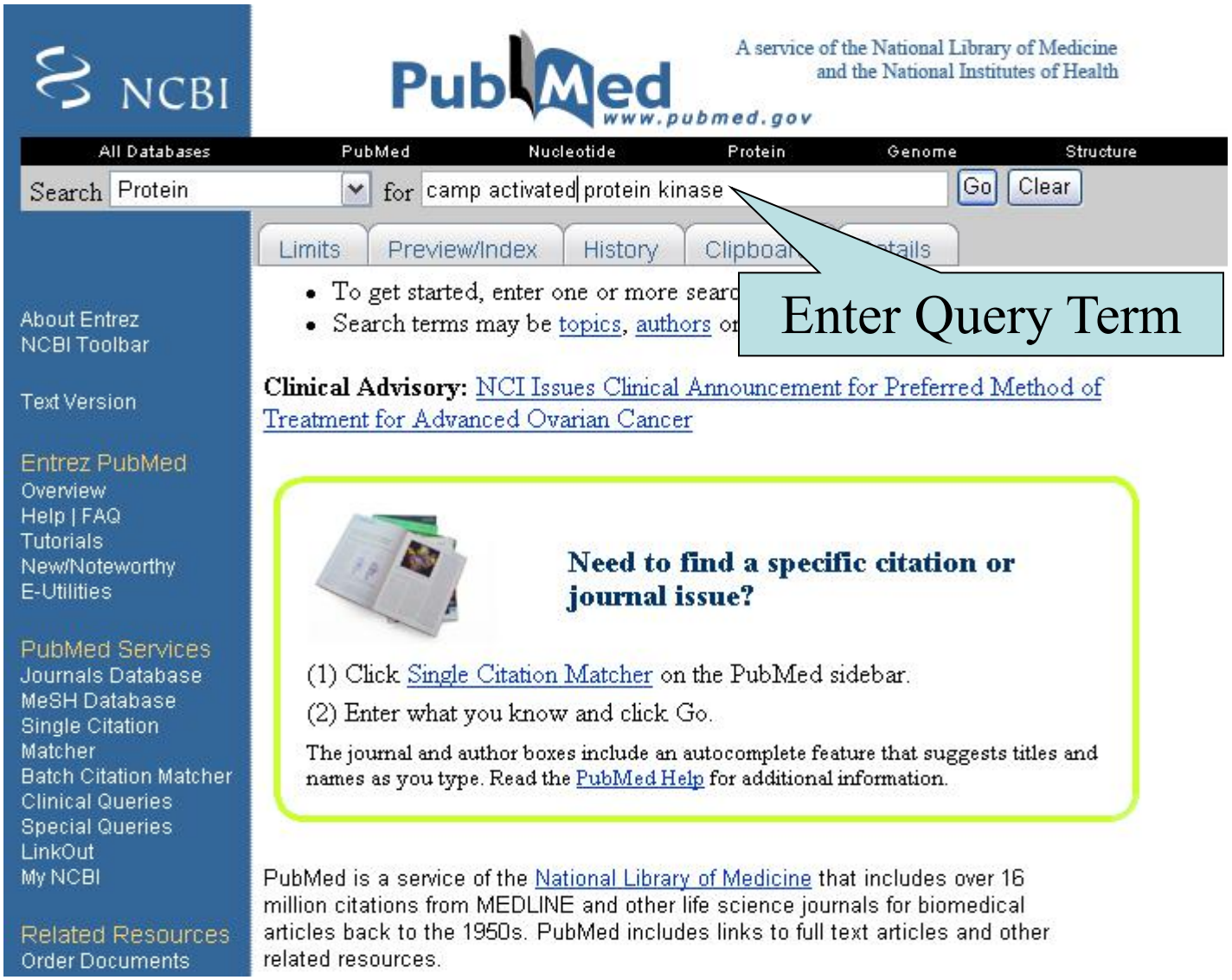
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PubMed
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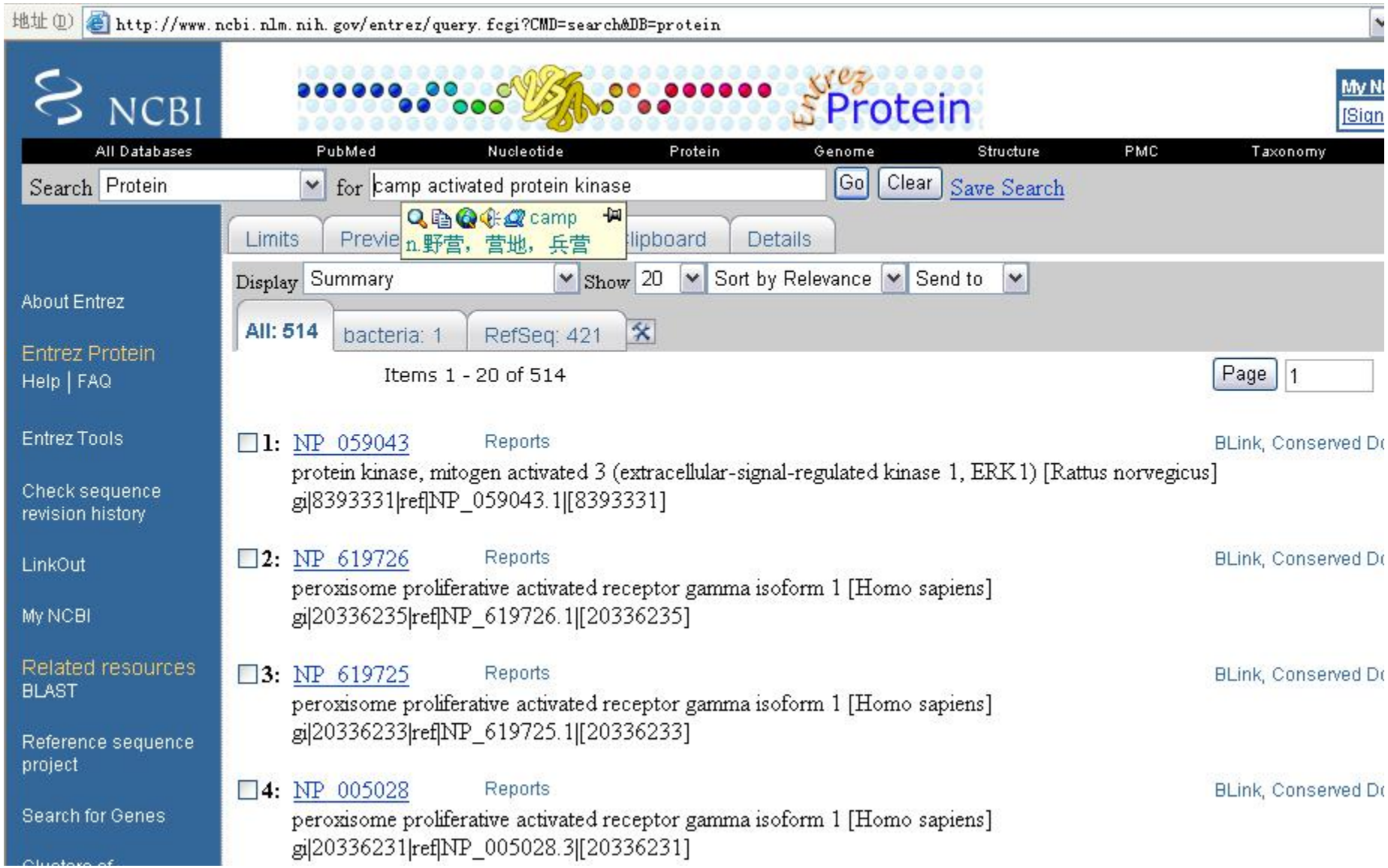
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All Databases PubMed Nucleotide Protein Genome Structure PMC Taxonomy
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About Entrez
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BLAST
Reference sequence project
Search for Genes
1: NP_059043 Reports BLink, Conserved Do
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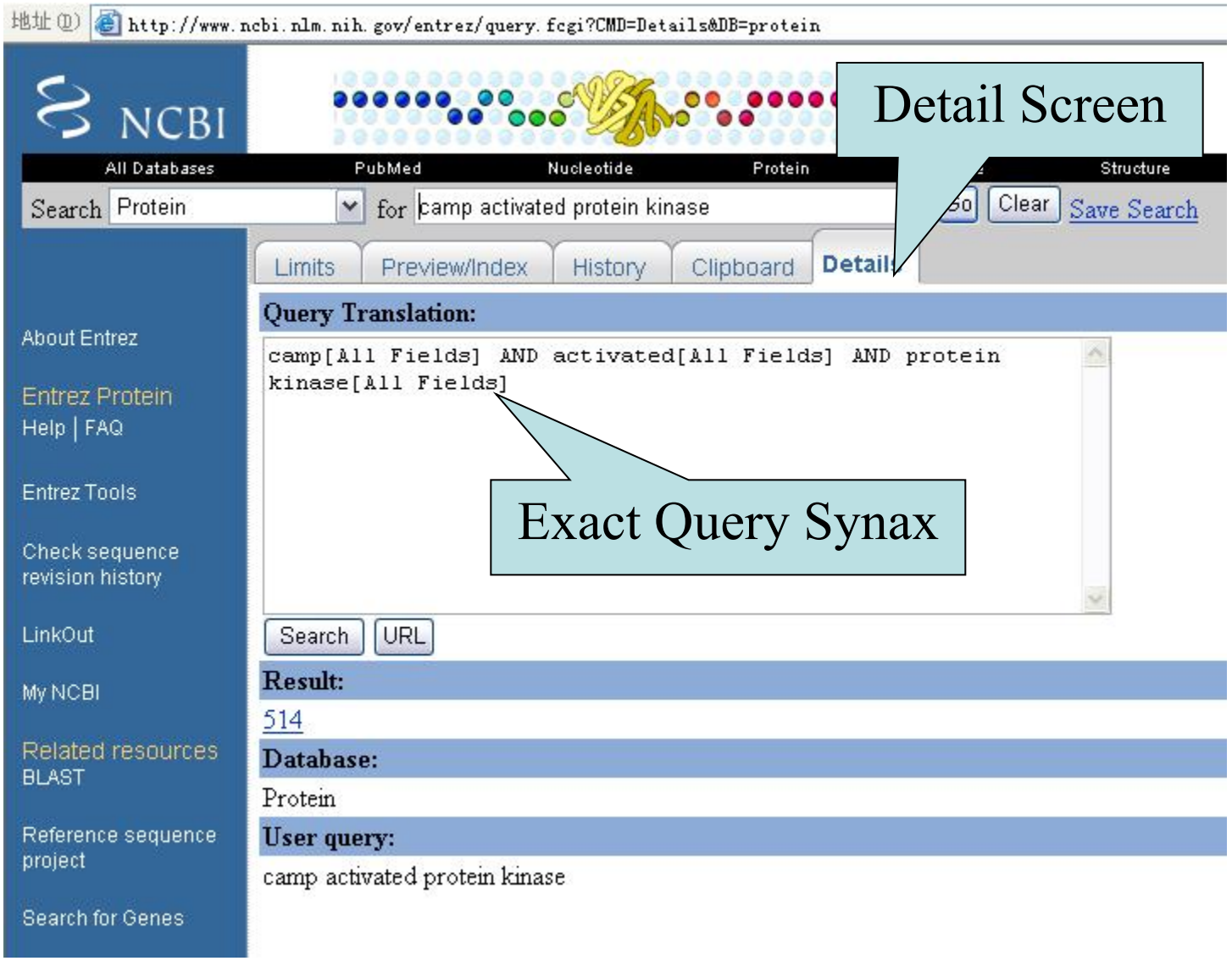
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NCBI
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Search Protein for camp activated protein kinase Clear Save Search
Limits Preview/Index History Clipboard Details
About Entrez
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Related resources BLAST
Reference sequence project
Search for Genes
Query Translation:
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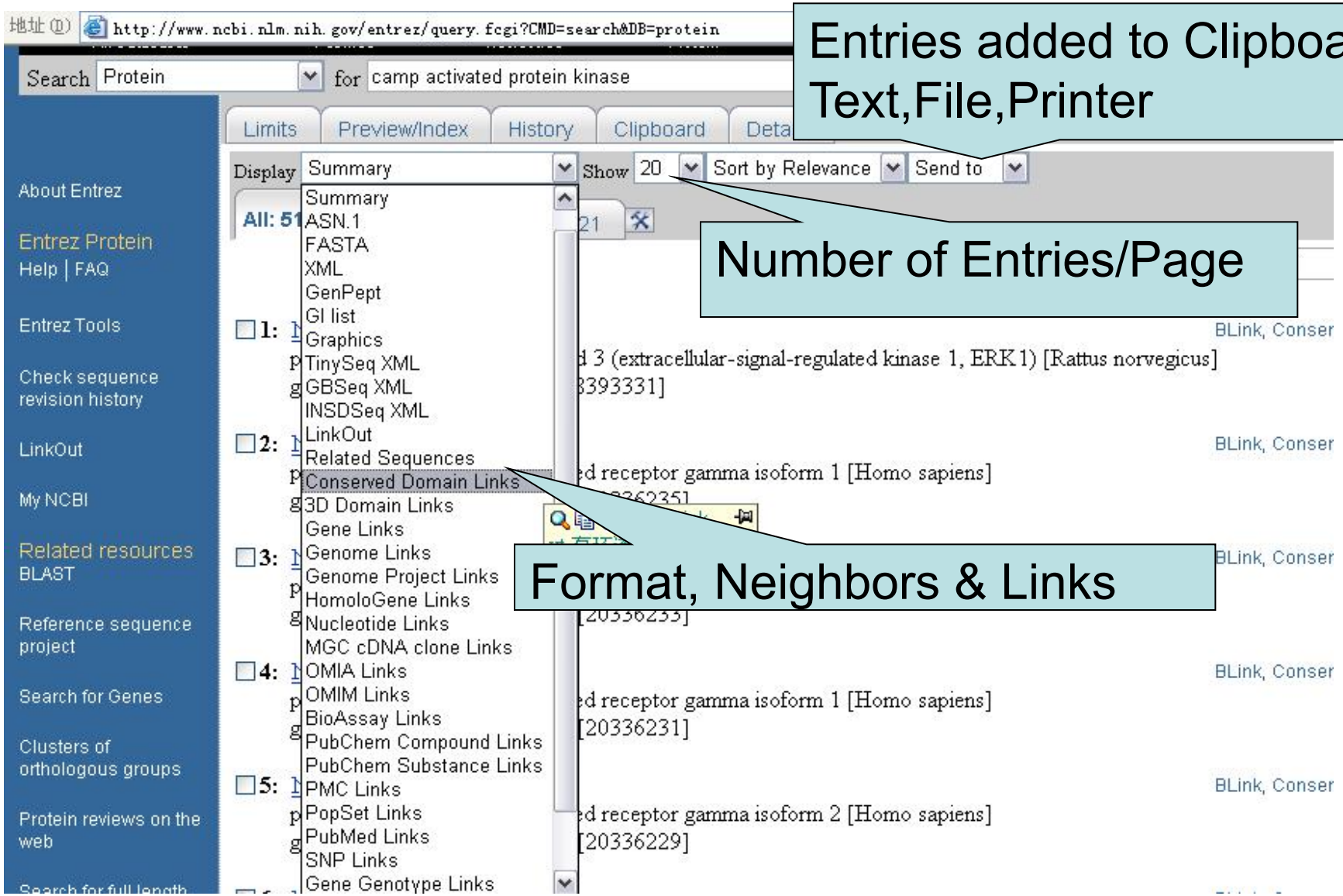
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3D Domain Links
Gene Links
Genome Links
Genome Project Links
HomoloGene Links
Nucleotide Links
MGC cDNA clone Links
OMIA Links
OMIM Links
BioAssay Links
PubChem Compound Links
PubChem Substance Links
PMC Links
PopSet Links
PubMed Links
SNP Links
Gene Genotype Links
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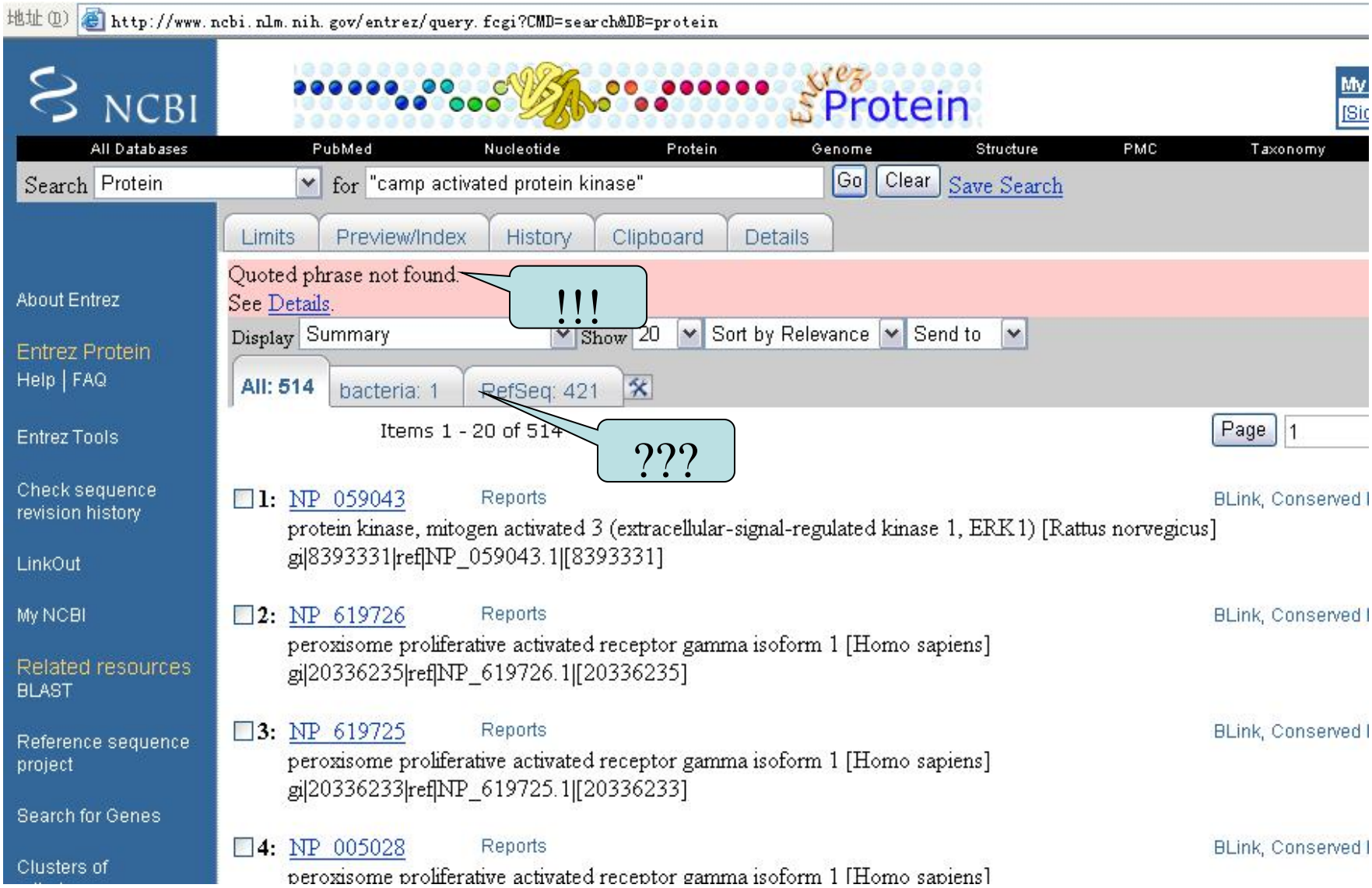
Protein reviews on the web
BLink, Conser
Entries added to Clipboard, Text,File,Printer
Number of Entries/Page
Format, Neighbors & Links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Entrez Protein
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3: NP_619725 Reports BLink, Conserved I
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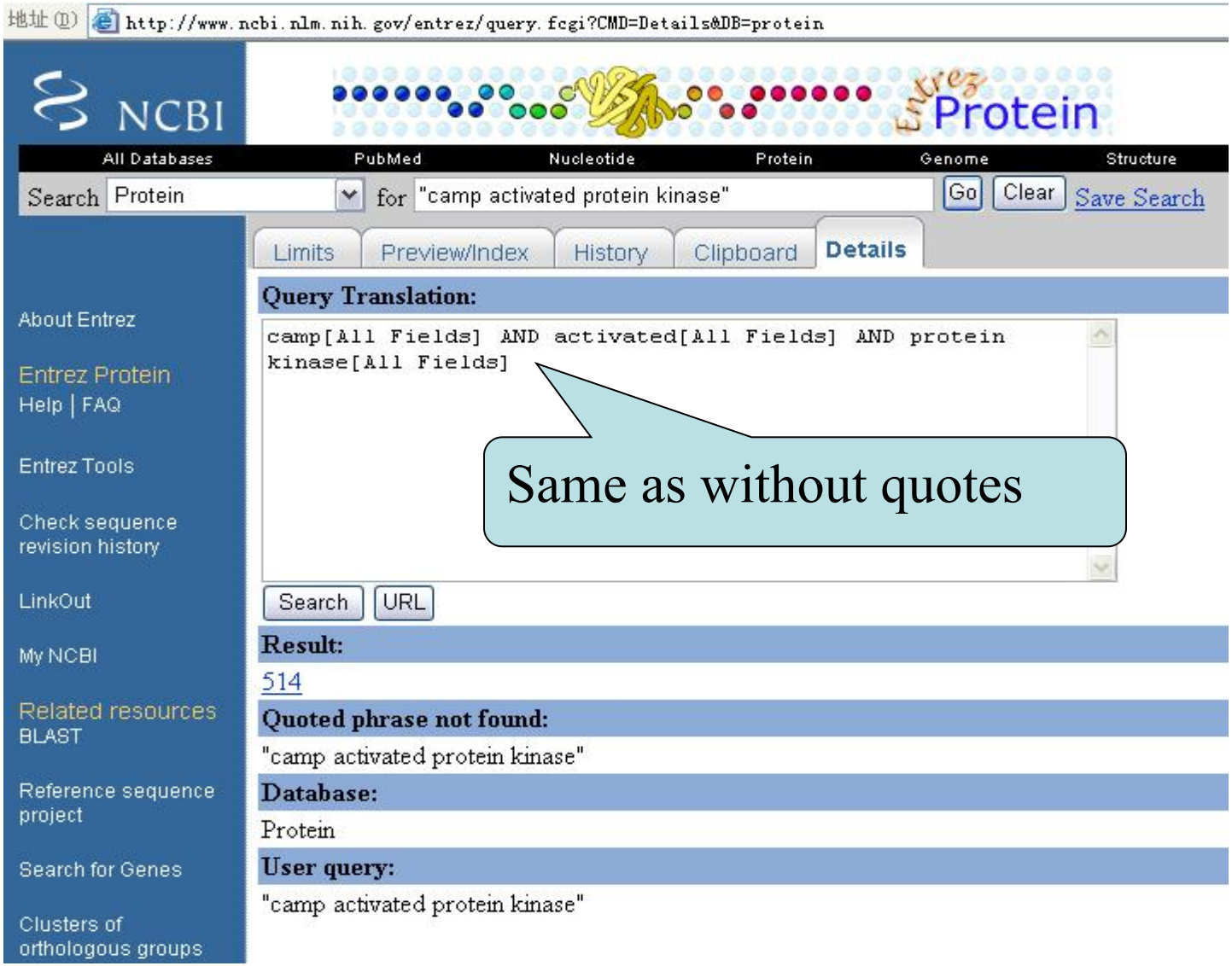
gi|20336233|ref|NP_619725.1|[20336233]
4: NP_005028 Reports BLink, Conserved I
peroxisome proliferative activated receptor gamma isoform 1 [Homo sapiens]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Search Protein for "camp activated protein kinase" Go Clear Save Search
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Search for Genes
Clusters of orthologous groups
Query Translation:
camp[All Fields] AND activated[All Fields] AND protein kinase[All Fields]
Same as without quotes
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Result:
514
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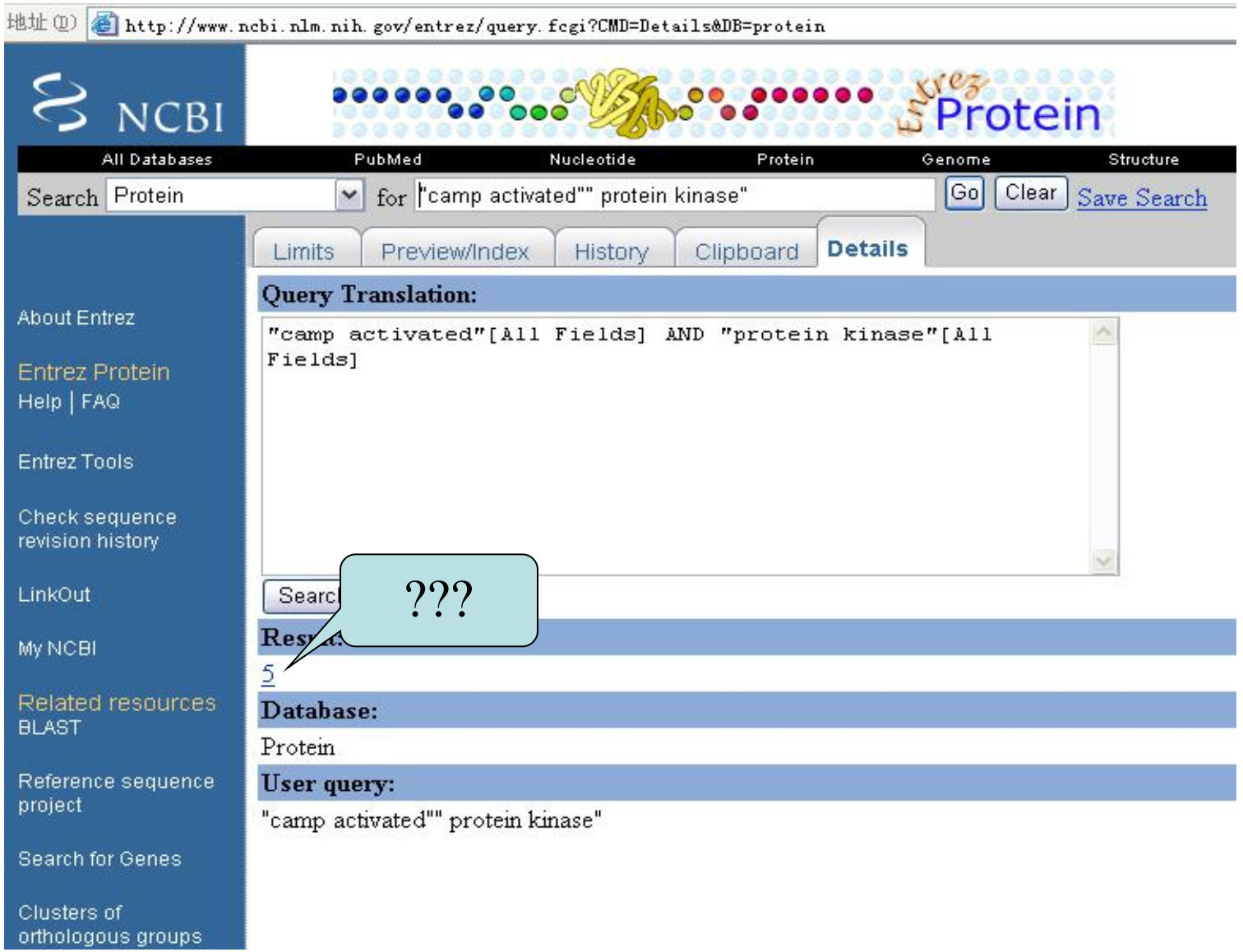
Database:
Protein
User query:
"camp activated protein kinase"


地址(D) http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?CMD=Details&DB=protein
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Clusters of orthologous groups
Query Translation:
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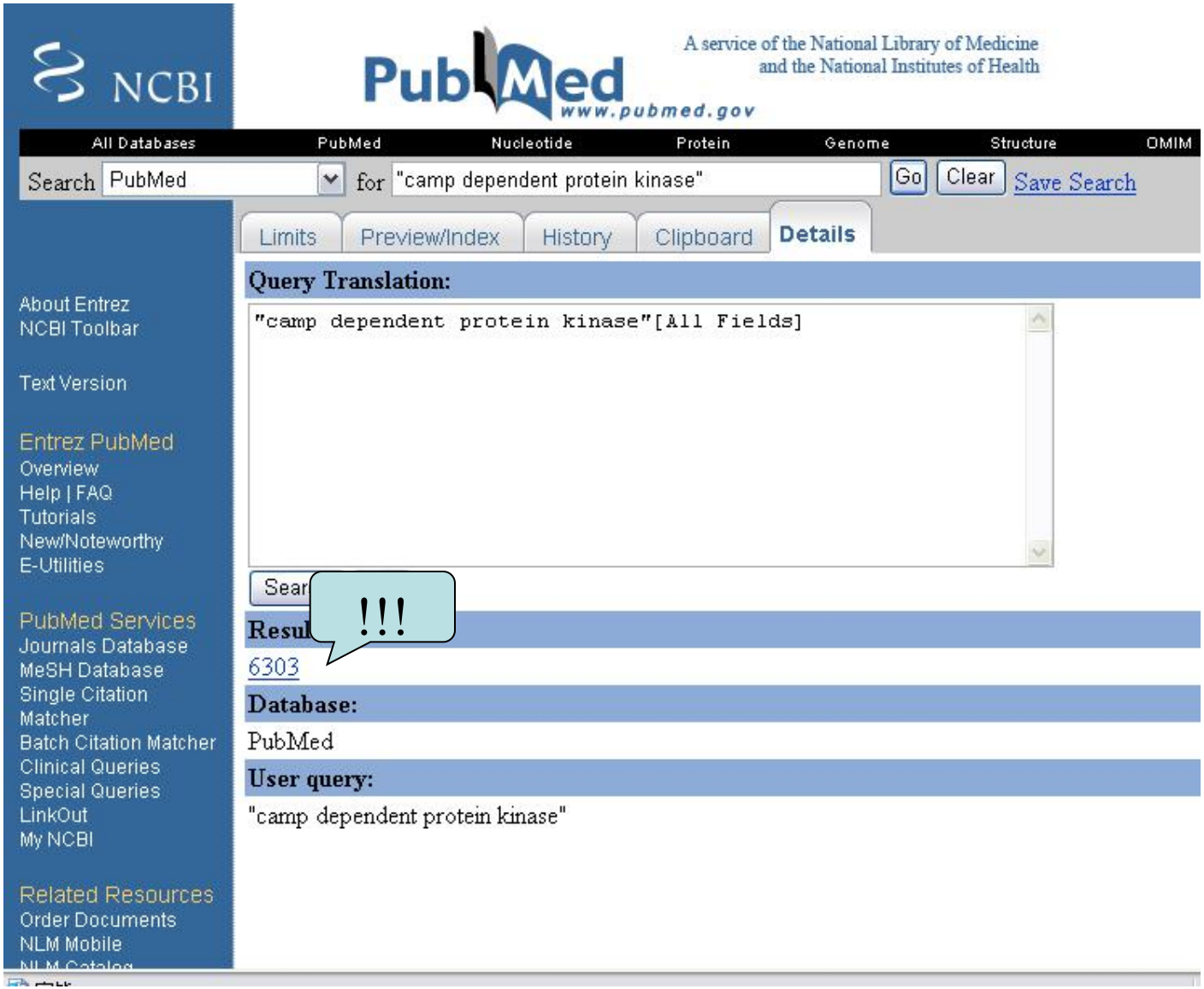
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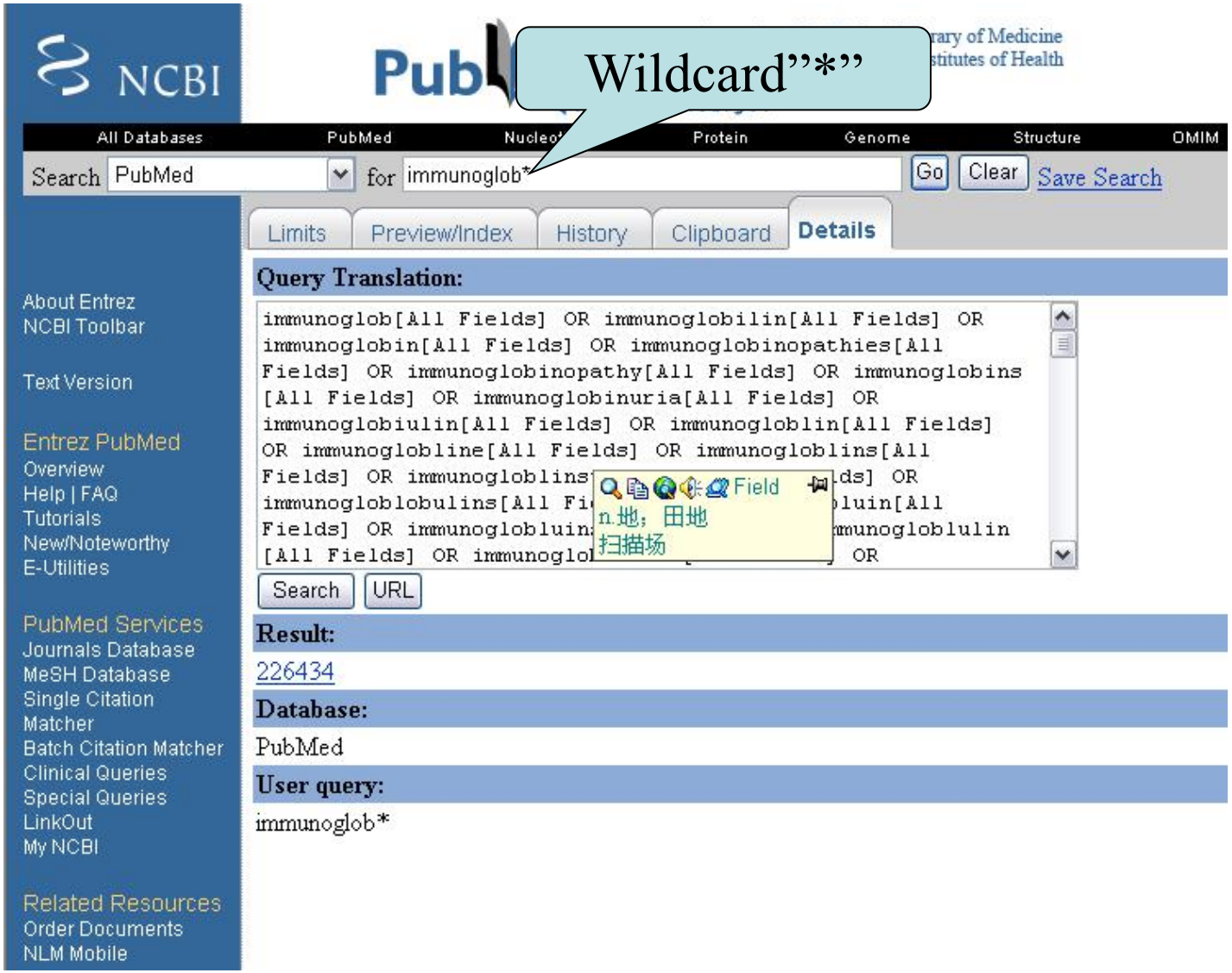
PubMed
User query:
"camp dependent protein kinase"


NCBI
Wildcard"*"
All Databases PubMed Protein Genome Structure OMIM
Search PubMed for immunoglob* Go Clear Save Search
Limits Preview/Index History Clipboard Details
Query Translation:
immunoglob[All Fields] OR immunoglobilin[All Fields] OR immunoglobin[All Fields] OR immunoglobinopathies[All Fields] OR immunoglobinopathy[All Fields] OR immunoglobins[All Fields] OR immunoglobinuria[All Fields] OR immunoglobiulin[All Fields] OR immunogloblin[All Fields] OR immunoglobline[All Fields] OR immunogloblins[All
Search URL
Result:
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Database:
PubMed
User query:
immunoglob*
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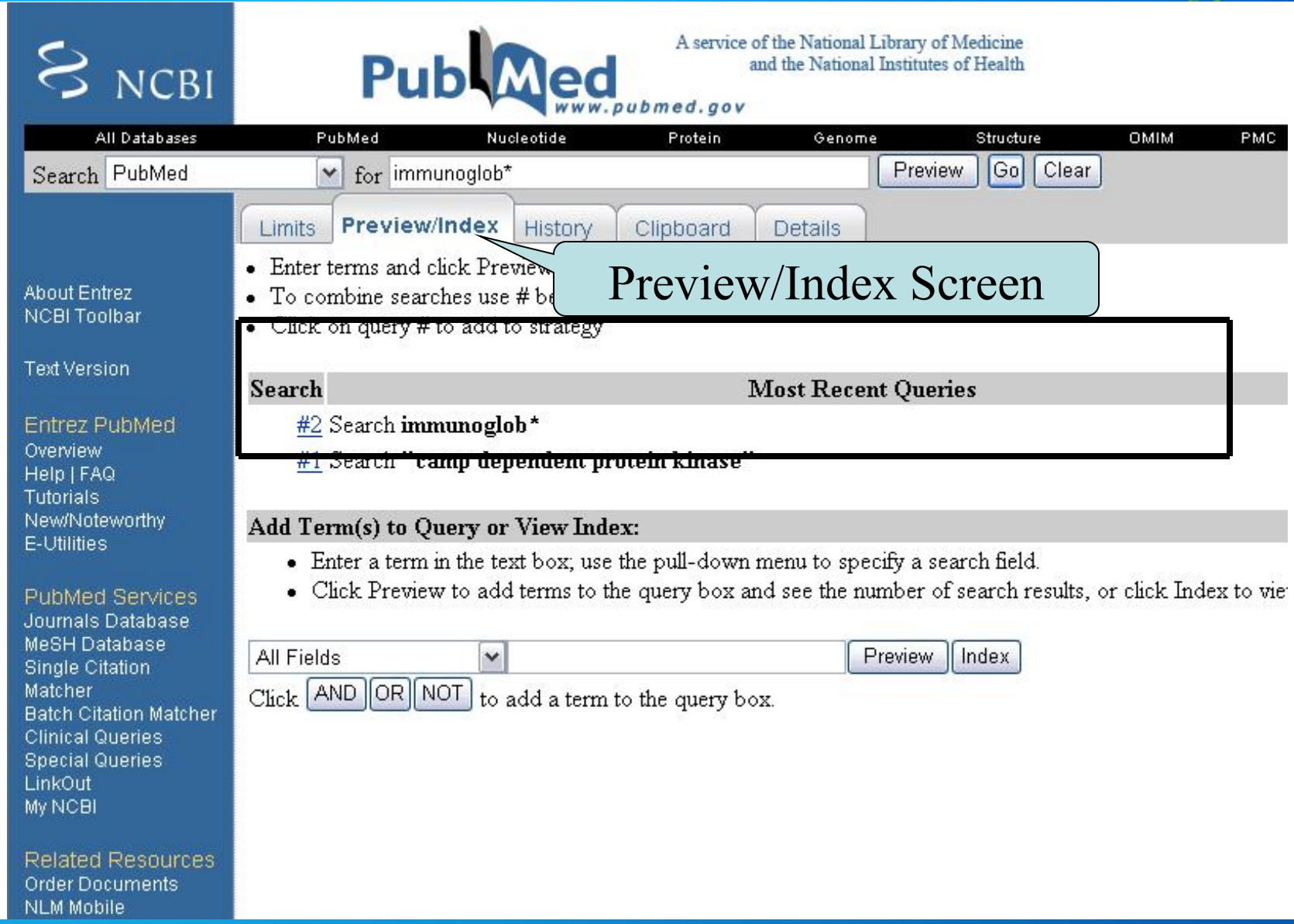
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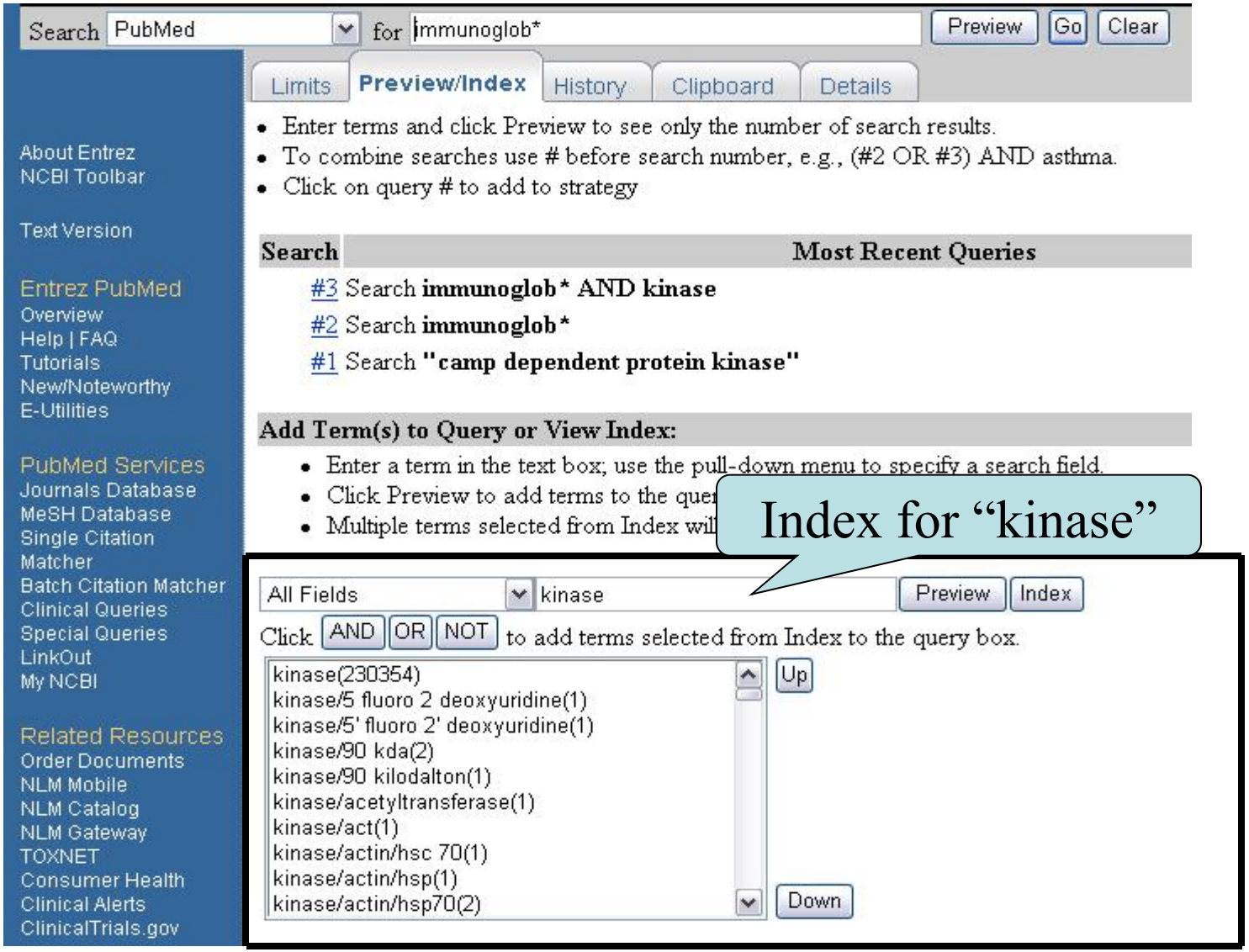
Enter terms and click Preview
To combine searches use #
Click on query # to add to strategy
Search Most Recent Queries
#2 Search immunoglob*
#1 Search "camp dependent protein kinase"
Add Term(s) to Query or View Index:
Enter a term in the text box; use the pull-down menu to specify a search field.
Click Preview to add terms to the query box and see the number of search results, or click Index to vie
All Fields Preview Index
Click AND OR NOT to add a term to the query box.


Search PubMed for immunoglob* Preview Go Clear
Limits Preview/Index History Clipboard Details
Enter terms and click Preview to see only the number of search results.
To combine searches use # before search number, e.g., (#2 OR #3) AND asthma.
Click on query # to add to strategy
Search Most Recent Queries
#3 Search immunoglob* AND kinase
#2 Search immunoglob*
#1 Search "camp dependent protein kinase"
Add Term(s) to Query or View Index:
Enter a term in the text box; use the pull-down menu to specify a search field.
Click Preview to add terms to the quer
Multiple terms selected from Index wil
Index for "kinase"
All Fields kinase Preview Index
Click AND OR NOT to add terms selected from Index to the query box.
kinase(230354)
kinase/5 fluoro 2 deoxyuridine(1)
kinase/5' fluoro 2' deoxyuridine(1)
kinase/90 kda(2)
kinase/90 kilodalton(1)
kinase/acetyltransferase(1)
kinase/act(1)
kinase/actin/hsc 70(1)
kinase/actin/hsp(1)
kinase/actin/hsp70(2)
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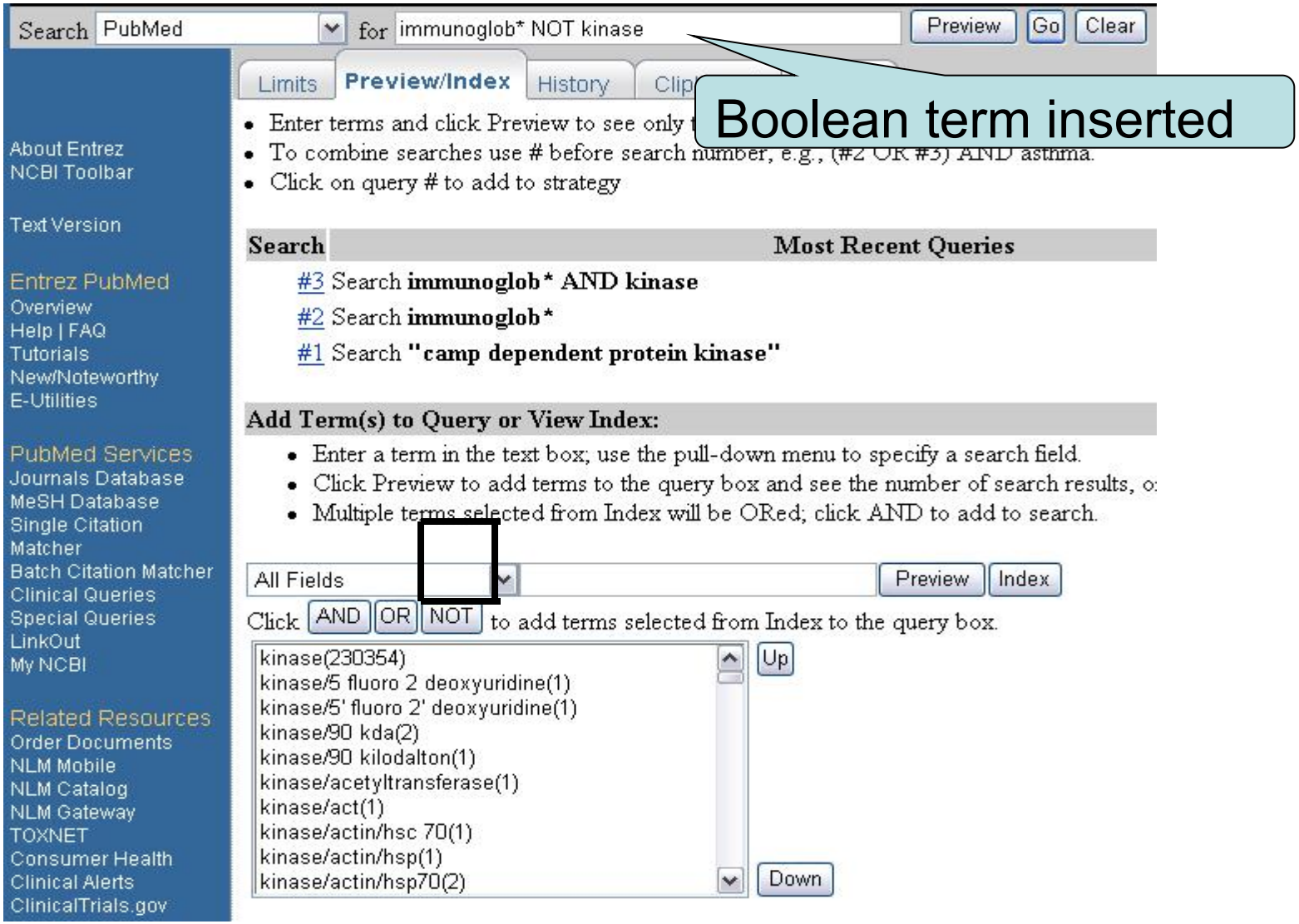
TOXNET
Consumer Health
Clinical Alerts
ClinicalTrials.gov


Search PubMed for immunoglob* NOT kinase
Preview Go Clear
Limits Preview/Index History Clip
Boolean term inserted
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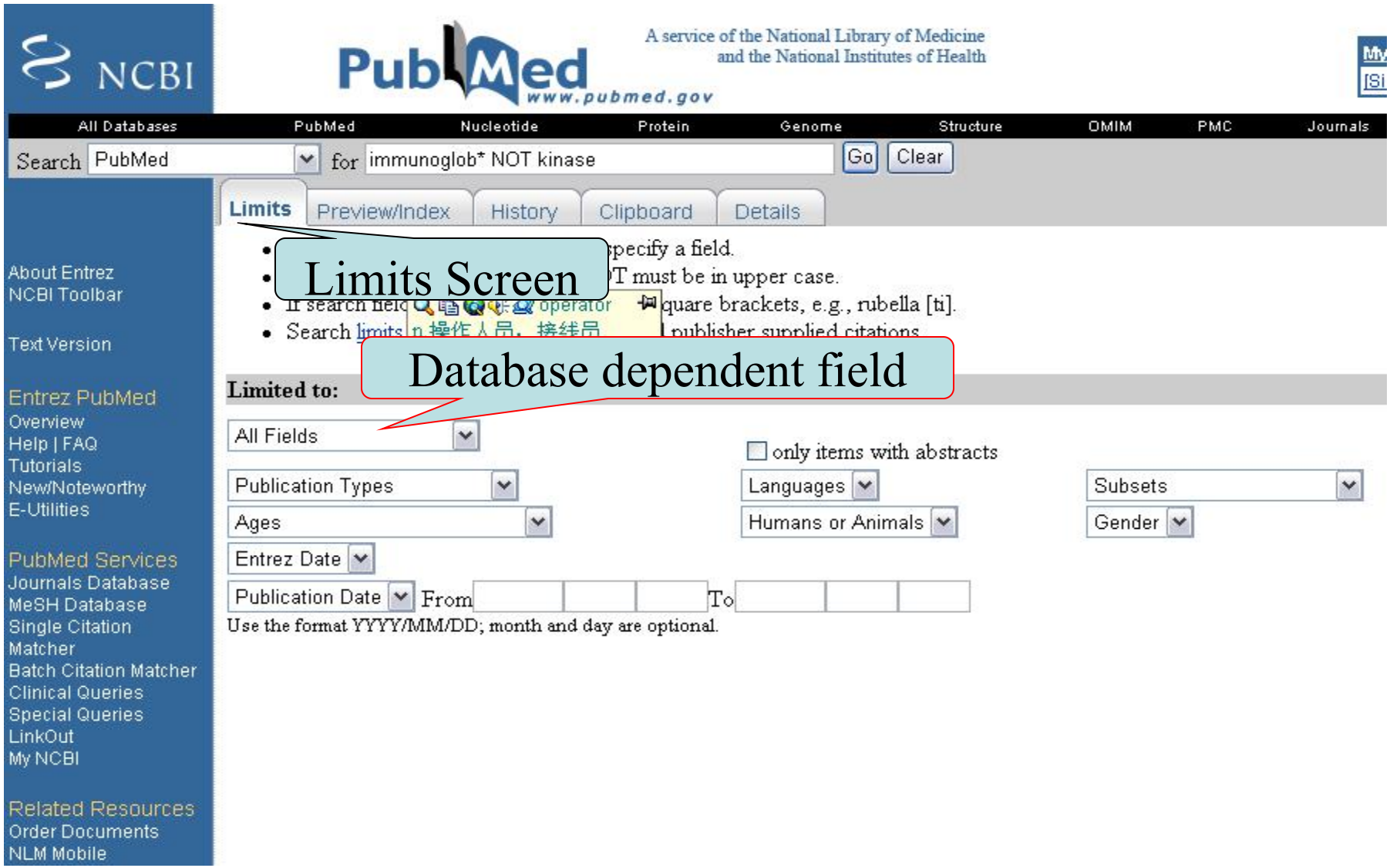
Consumer Health
Clinical Alerts
ClinicalTrials.gov
Enter terms and click Preview to see only t
To combine searches use # before search number, e.g., (#2 OR #3) AND asthma.
Click on query # to add to strategy
Search
Most Recent Queries
#3 Search immunoglob* AND kinase
#2 Search immunoglob*
#1 Search "camp dependent protein kinase"
Add Term(s) to Query or View Index:
Enter a term in the text box; use the pull-down menu to specify a search field.
Click Preview to add terms to the query box and see the number of search results, o
Multiple terms selected from Index will be ORed; click AND to add to search.
All Fields
Preview Index
Click AND OR NOT to add terms selected from Index to the query box.
kinase(230354)
kinase/5 fluoro 2 deoxyuridine(1)
kinase/5' fluoro 2' deoxyuridine(1)
kinase/90 kda(2)
kinase/90 kilodalton(1)
kinase/acetyltransferase(1)
kinase/act(1)
kinase/actin/hsc 70(1)
kinase/actin/hsp(1)
kinase/actin/hsp70(2)
Up
Down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Limited to:
All Fields
only items with abstracts
Publication Types
Languages
Subsets
Ages
Humans or Animals
Gender
Entrez Date
Publication Date From To
Use the format YYYY/MM/DD; month and day are optional.

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Batch Citation Matcher
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Special Queries
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My NCBI
Field: Author
Query Translation:
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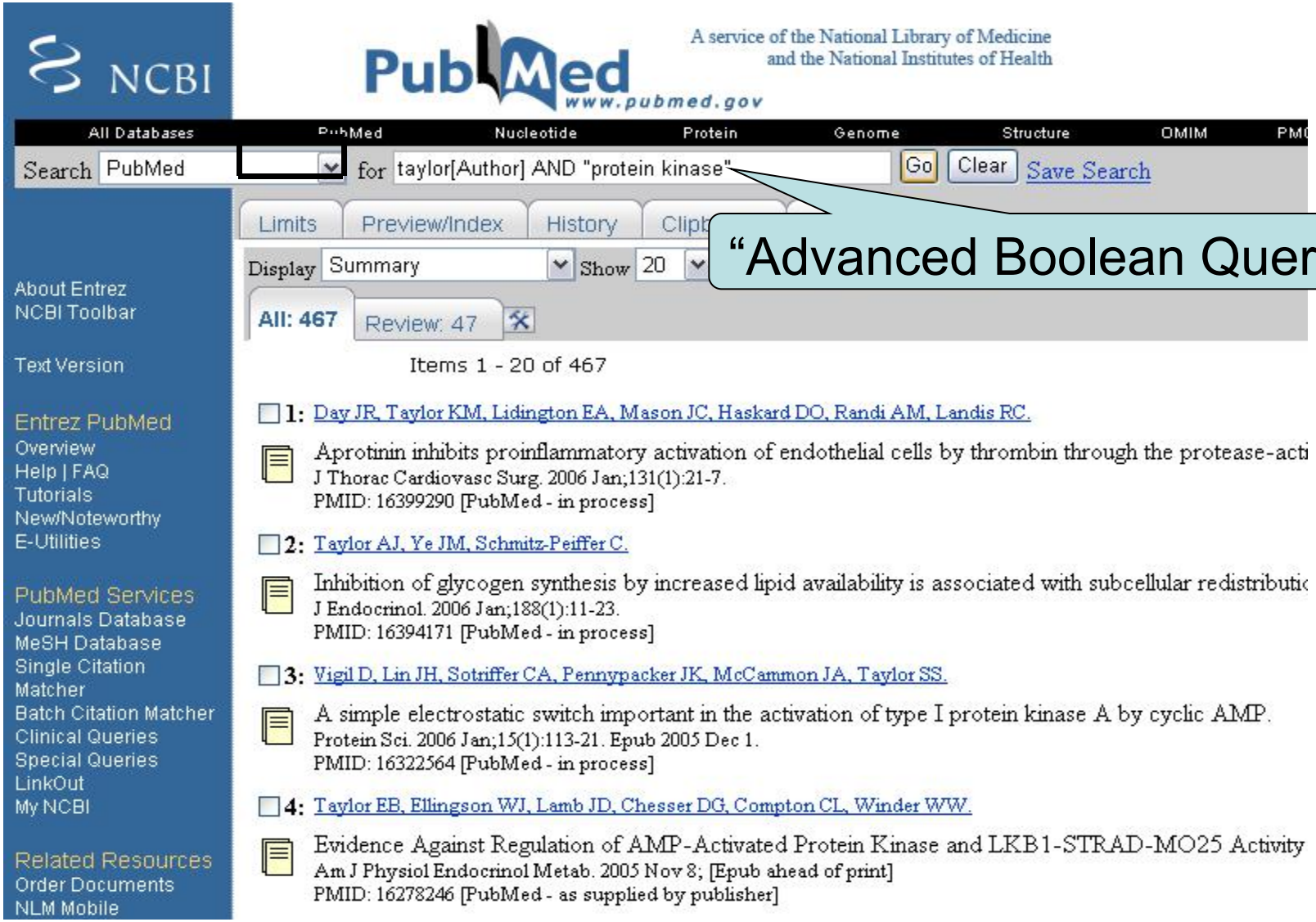
46911
Database:
PubMed
User query:
taylor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Search PubMed for taylor[Author] AND "protein kinase" Go Clear Save Search
Limits Preview/Index History
Display Summary Show 20
All: 467 Review: 47
Items 1 - 20 of 467
1: Day JR, Taylor KM, Lidington EA, Mason JC, Haskard DO, Randi AM, Landis RC.
Aprotinin inhibits proinflammatory activation of endothelial cells by thrombin through the protease-acti
J Thorac Cardiovasc Surg. 2006 Jan;131(1):21-7.
PMID: 16399290 [PubMed - in process]
2: Taylor AJ, Ye JM, Schmitz-Peiffer C.
Inhibition of glycogen synthesis by increased lipid availability is associated with subcellular redistributi
J Endocrinol. 2006 Jan;188(1):11-23.
PMID: 16394171 [PubMed - in process]
3: Vigil D, Lin JH, Sotriffer CA, Pennypacker JK, McCammon JA, Taylor SS.
A simple electrostatic switch important in the activation of type I protein kinase A by cyclic AMP.
Protein Sci. 2006 Jan;15(1):113-21. Epub 2005 Dec 1.
PMID: 16322564 [PubMed - in process]
4: Taylor EB, Ellingson WJ, Lamb JD, Chesser DG, Compton CL, Winder WW.
Evidence Against Regulation of AMP-Activated Protein Kinase and LKB1-STRAD-MO25 Activity
Am J Physiol Endocrinol Metab. 2005 Nov 8; [Epub ahead of print]
PMID: 16278246 [PubMed - as supplied by publisher]
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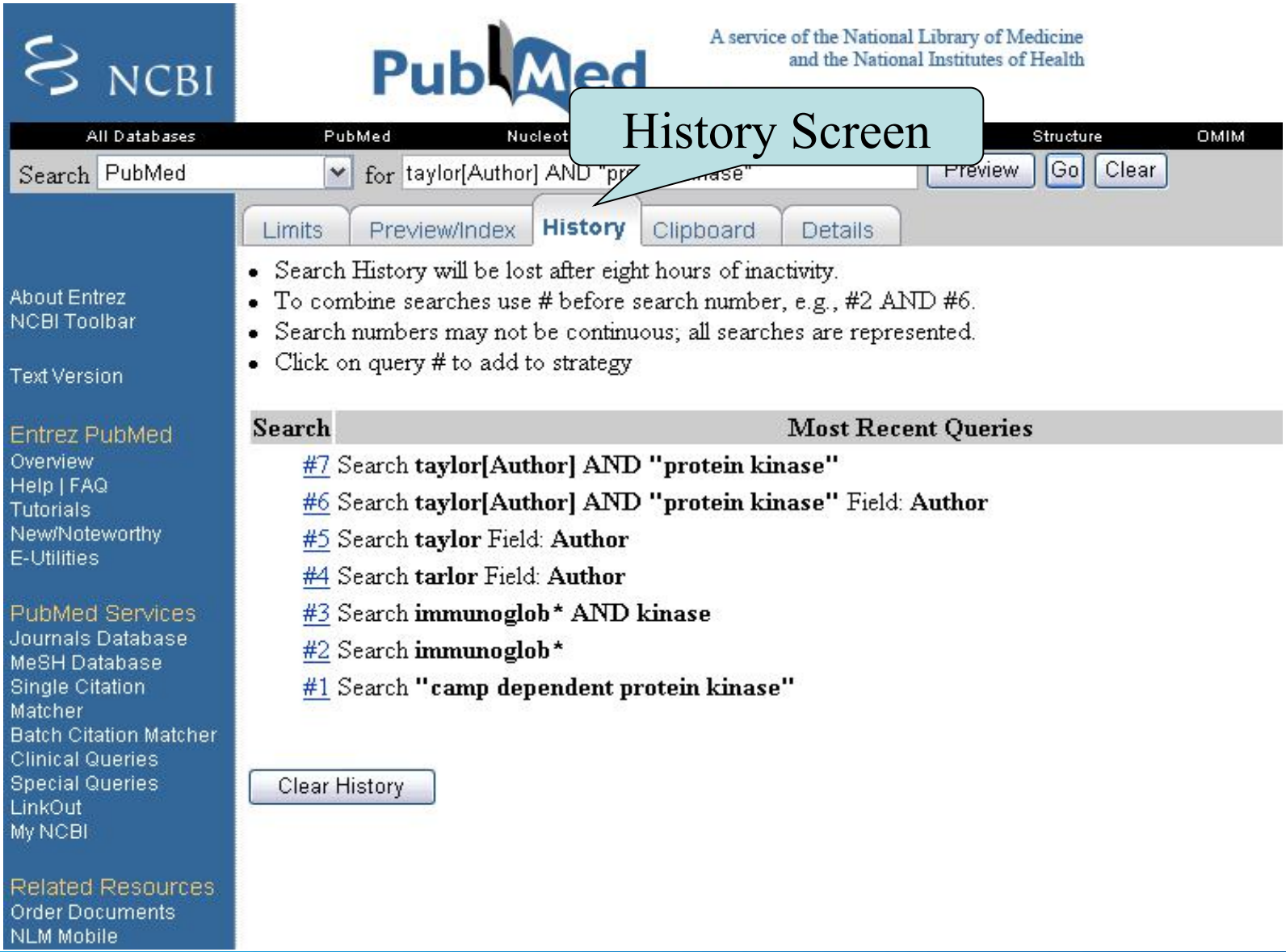
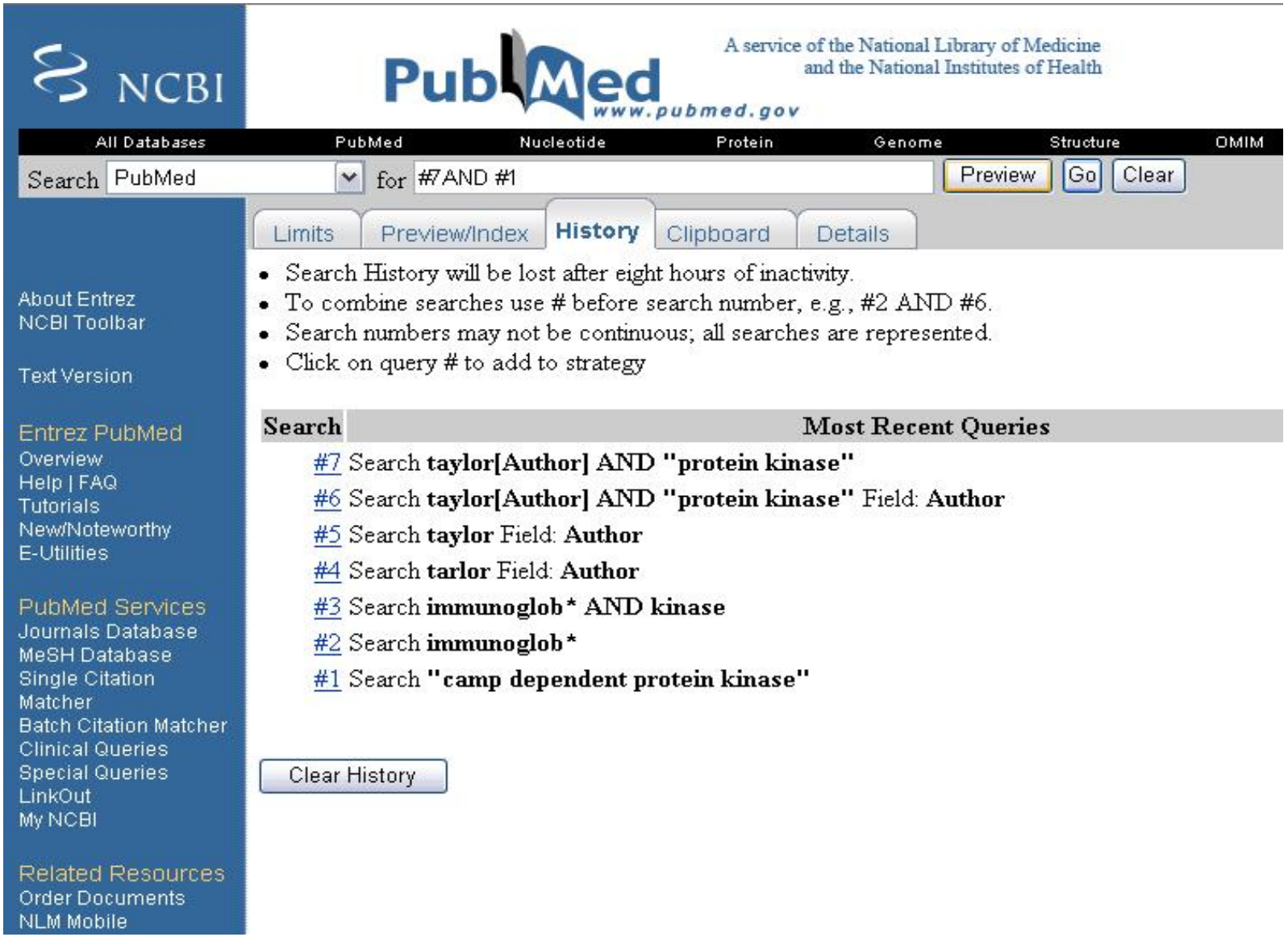
"Advanced Boolean Query"



- Search History will be lost after eight hours of inactivity.
- To combine searches use # before search number, e.g., #2 AND #6.
- Search numbers may not be continuous; all searches are represented.
- Click on query # to add to strategy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Search numbers may not be continuous; all searches are represented.
Click on query # to add to strategy
Search
Most Recent Queries
#7 Search taylor[Author] AND "protein kinase"
#6 Search taylor[Author] AND "protein kinase" Field: Author
#5 Search taylor Field: Author
#4 Search tarlor Field: Author
#3 Search immunoglob* AND kinase
#2 Search immunoglob*
#1 Search "camp dependent protein kinase"
Clear History

Basic Searching (Summary)

- Choose database
- Enter query term
- Hit "Go" button
- Examples:
  - **-- camp activated protein kinase**
  - **-- "camp activated protein kinase"**
  - **-- "camp activated" "protein kinase"**
  - **-- "camp dependent protein kinase"**
  - **-- "immunoglob*"**

Details, Limits, Preview …

- Details: review Entrez's interpretation of the query term
- Limits: ways to restrict a search to a defined subset of the database.
- Indexes: alphabetical lists of terms from searchable database fields
- History: review, recall and combine past searches
- Clipboard: temporarily store results

Field Qualifiers

- Format: **term [qualifier]**
- Where:
  - -- **Term** is the string to search for
  - -- **Qualifier** specify the field to search in
    - -- DB specific
    - -- one of WORD, TITL, MESH, MAJR, AUTH, JOUR,ECNO, GENE, DATE, PDAT, MDAT, PAGE, VOL, KYWD, ORGN, ACCN, PROT, SLEN, SQID, SUBS, PROP, FKEY, and PTYP
- Example: **Bourne PE [AUTH]**

ACCN accession number

DATE publication year

FKEY feature key

JOUR journal name

MAJR MeSH major topic

PAGE first page

PROP property

PTYP publication type

TITL title word

SLEN sequence length

WORD text word

AUTH author name

ECNO EC number

GENE gene name

KYWD keyword

MDAT modification date

ORGN organism

PDAT publication/creation date

PROT protein name

SQID sequence id

SUBS substance

VOL volume

Advanced Boolean Queries

- Format:

  -- term [field] operator term [field] …

- Where **Operator** is any of :

  -- AND (intersection)

  -- OR (union)

  -- BUTNOT (difference)

- Example:

  Taylor P [AUTH] AND "protein kinase"

- Ranges:

  -- term1:term2 [field]

Using "Related" Links

(aka "Neighbors")

- PubMed Neighbors
  -- Text & MeSH
- Protein and Nucleotide Neighbors
  -- BLAST
- Macromolecular Structure Neighbors
  -- VAST
- Non similarity based: references within
  -- text/annotation
- VERY helpful in identifying related records

Exercises

1. Work through the NCBI query tutorial at
   -- http://www.ncbi.nlm.nih.gov/Database/tut1.html
2. Find references about shingles and facial paralysis.
   -- Display the records in the format that shows the abstract and the MeSH headings. How does PubMed map the term, shingles?

3. Find murine nucleic acid sequences involved in apoptosis and cancer.

   -- Display all of the retrieved records on one Web page.

4. Find protein sequences related to AIDS with publications in Nature. Save this search strategy so the search can be run again at a later date.

5. Find all mouse or human nucleotide sequences added to Entrez in 1997.

-- How many structures correspond to your result set?

Thanks for your attentions !