Finding Data in the IEDB

Using the query interfaces

Nima Salimi. M.S. - Sr. Biocurator/Curation Mgr

Kerrie Vaughan, PhD - Sr. Biocurator/Meta-Analysis

Overview

Introduction

- IEDB Home page search
- Exploring the query results
- Finders
- Specialized Searches (all fields)

Break

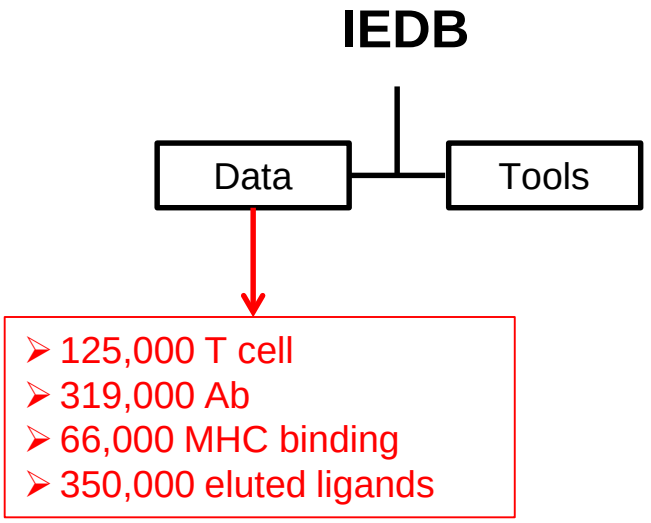
- Immunome Browser
- Example queries & demos (live)

Lunch

- Exercises (live)
- Participant-derived queries

How can the search interface be useful to me?

1. Finding epitopes (tested)
2. ‘Big picture’ analyses
3. Validation

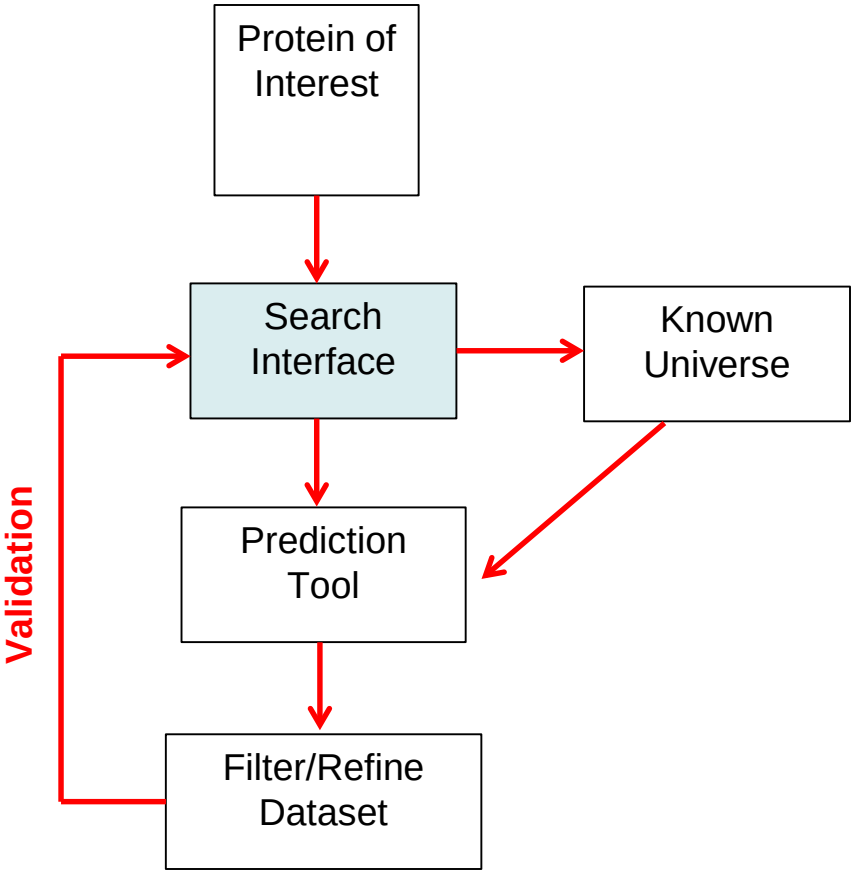


➡ Helps defines ‘known universe’

What has and has not been done

➡ Part of prediction or informatics pipeline

Maximize the Available Information Pipeline



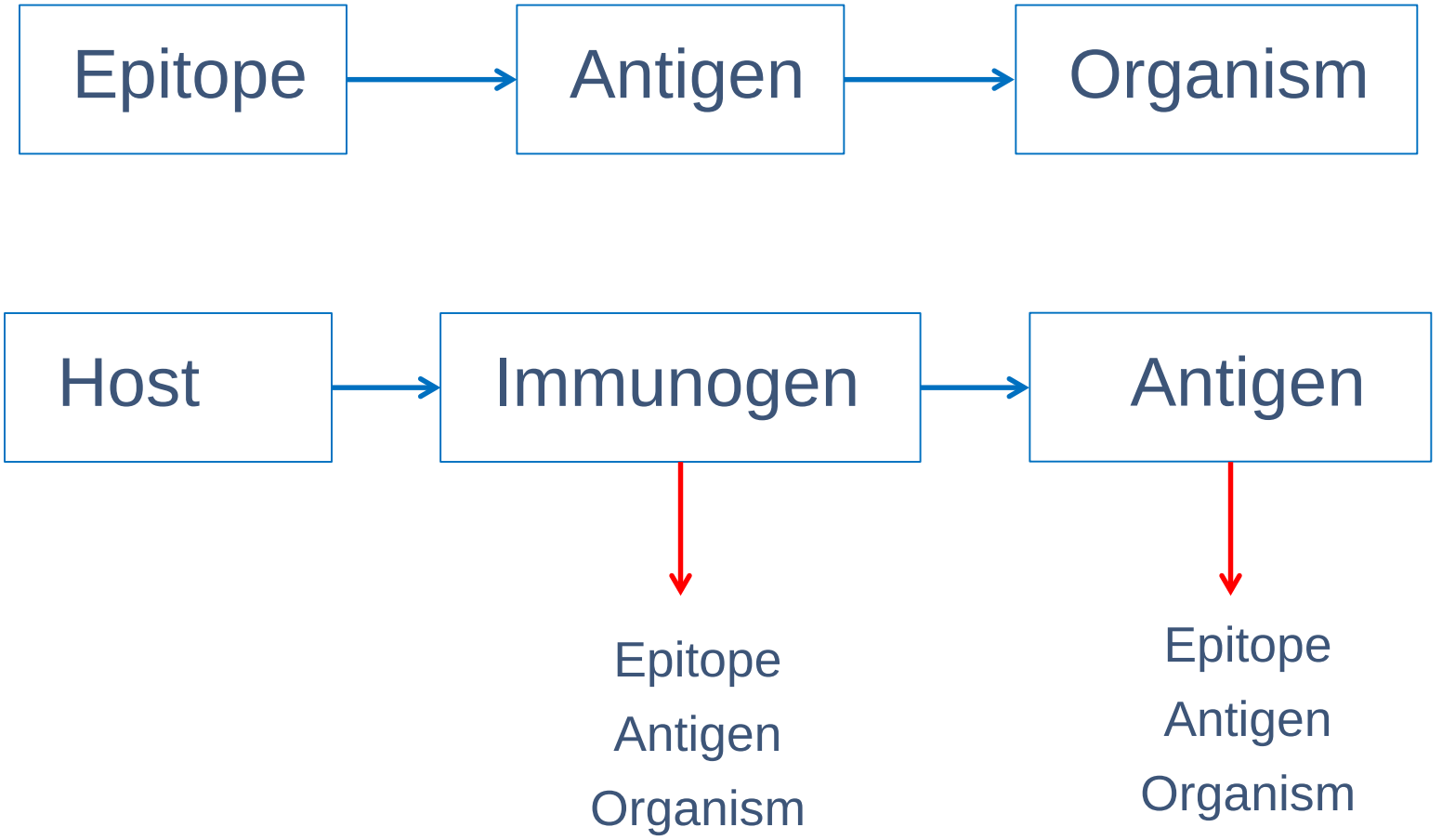
IEDB 'Jargon'

- Terms unique to the IEDB
  - A. Immunologic in nature
    - Immunogen, antigen, assay, in vivo admin, in vitro admin, occurrence of, IV1, IV2, process type
  - B. Ontological (database interoperability)
    - Relation, parent, child, sibling
  - C. Database necessity (explicit/constrained)
    - Source antigen, Source organism, Non-peptidic v. peptidic, B cell/Ab

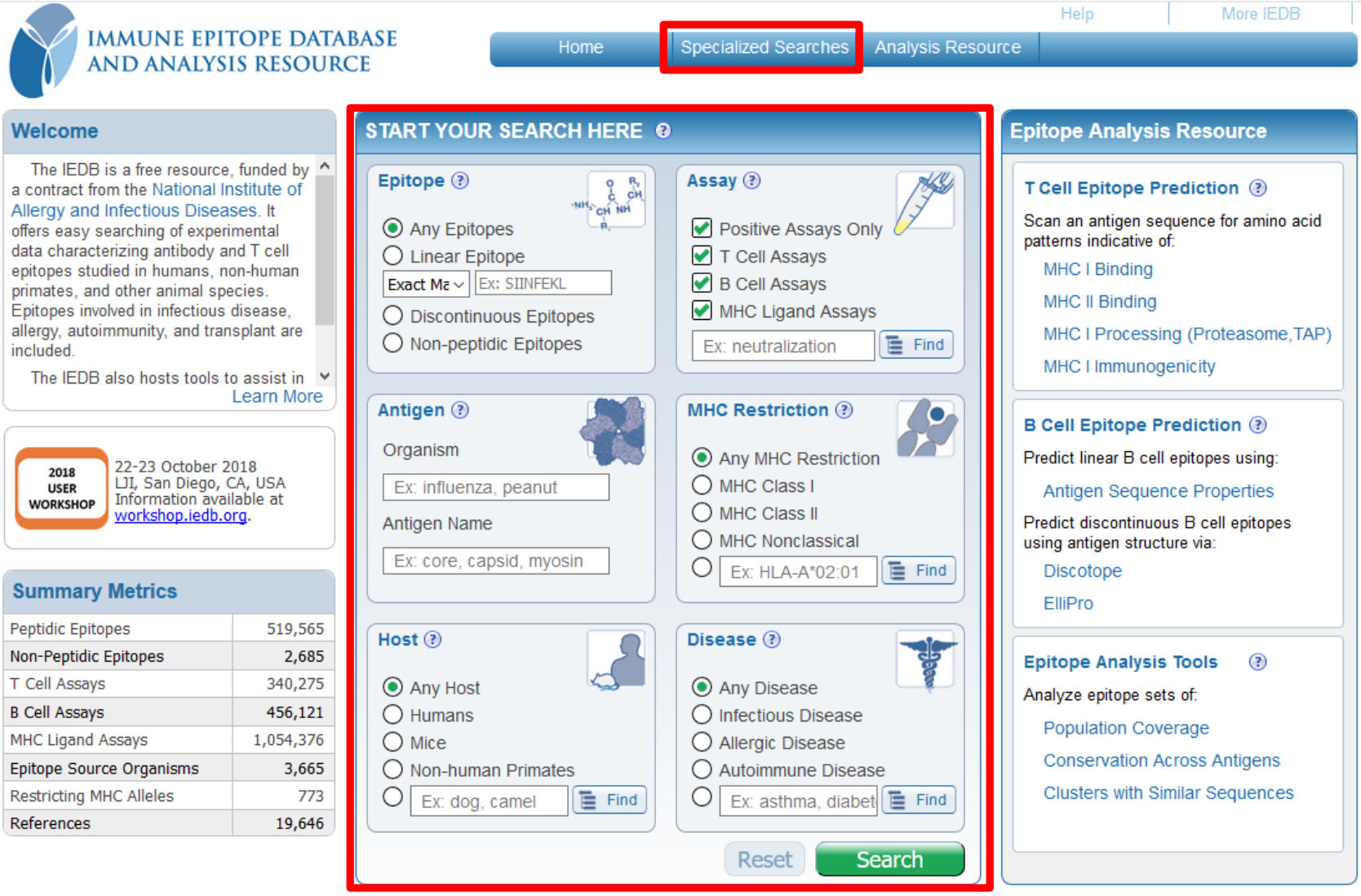
- Link to Field Descriptions and Curation Manual:

  http://curationwiki.iedb.org/wiki/index.php/Main_Page

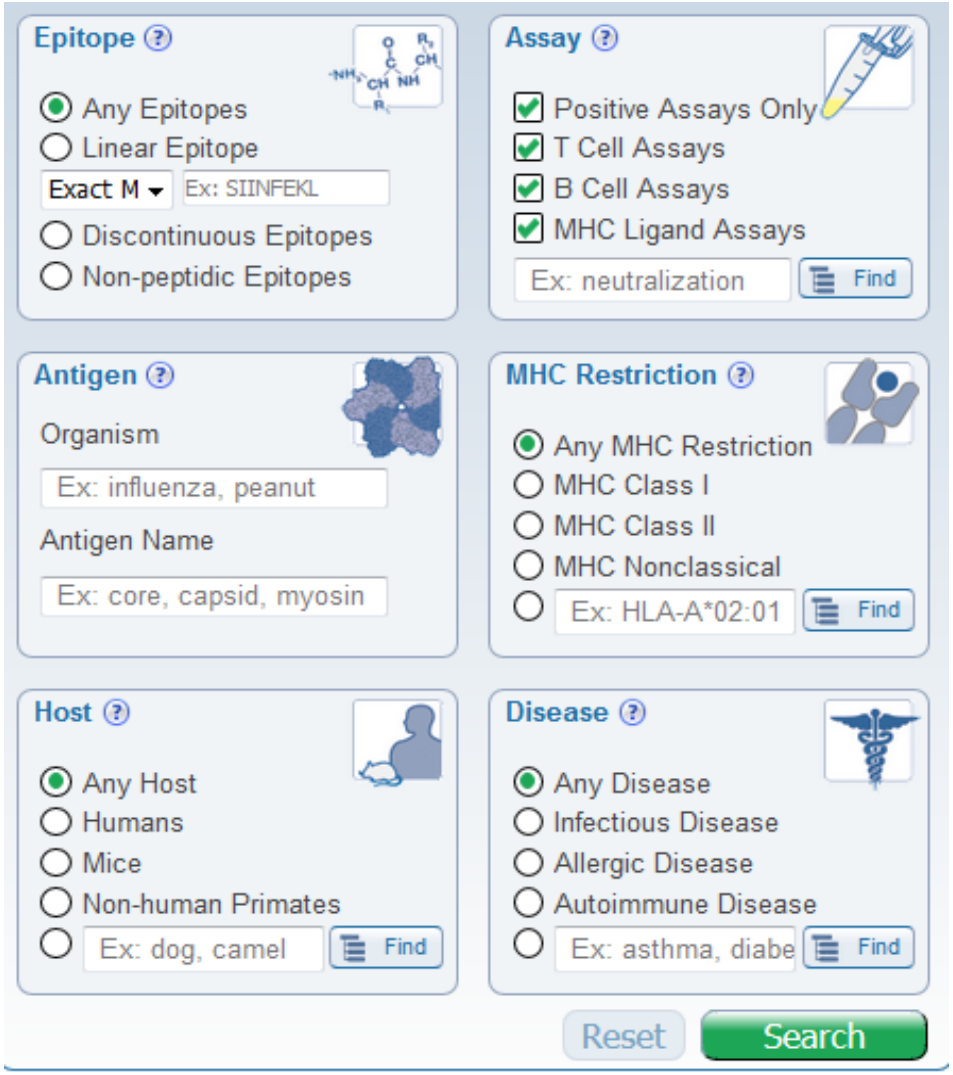
Assay-centric nature of the data



IEDB Home Page



Home Page Search Interface



Search by:

- Epitope sequence
- Antigen
- Host
- MHC restriction
- Disease
- Assay type

Tailored to represent key elements of immune response - context and characteristics

Exploring the Results Page

IMMUNE EPITOPE DATABASE AND ANALYSIS RESOURCE

Home | Specialized Searches | Analysis Resource

Query results
Tab delineated summary
Columns (fields) and rows (data)

Pending Filters

Reset | Search

Epitope
- Any Epitopes
- Linear Epitope
- Discontinuous Epitopes
- Non-peptidic Epitopes

3D structure available
Amino Acid Modification

Antigen
Organism: Ex: influenza, peanut
Antigen Name: Ex: core, capsid, myosin

Receptor
Has receptor sequence
Type: Any Type
Chain: Any Type
Sequence: Exact Matches

Assay
Positive Assays Only
T Cell Assays
B Cell Assays
MHC Ligand Assays

Current Filters: Positive Assays Only

Epitopes (522250) | Antigens (42401) | Assays (1206199) | Receptors (18292) | References (19537)

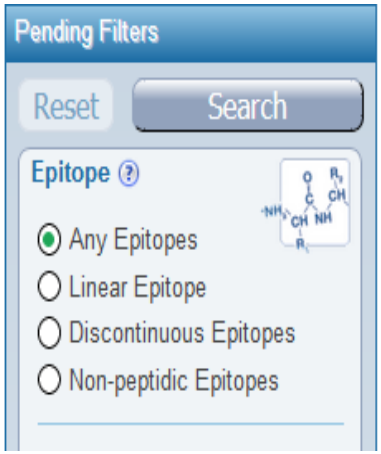
Go To Records Starting At 1200 GO | Export Results

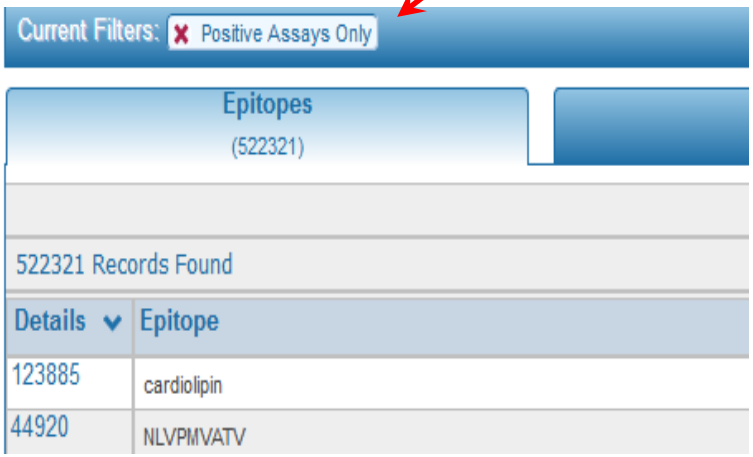
522250 Records Found | Page 1 of 20890 | 25 Per Page

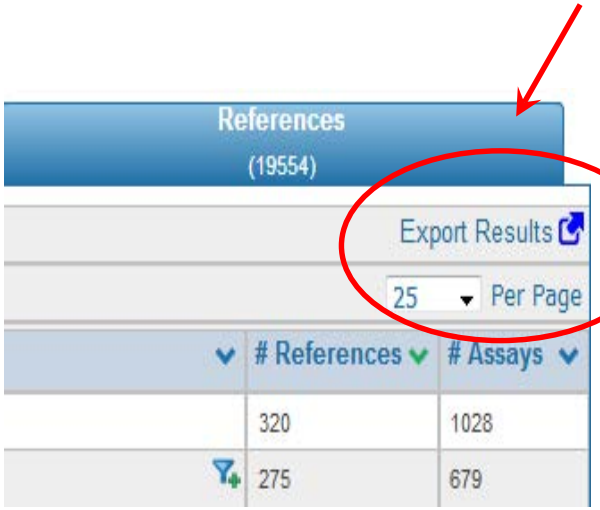
Details	Epitope	Antigen	Organism	# References	# Assays
123885	cardiolipin			320	1028
44920	NLVPMVATV	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)	275	679
20354	GILGFVFTL	Matrix protein 1	Influenza A virus	204	558
113645	MEVGWYRSPFSRVVHLYRNGK	Myelin-oligodendrocyte glycoprotein	Mus musculus (mouse)	187	975
58560	SIINFEKL	Gal d 2	Gallus gallus (chicken)	171	444
4602	ASNENMETM	Nucleoprotein	Influenza A virus	144	397
112741	2,4-dinitrophenyl group			140	477
20788	GLCTLVAML	mRNA export factor ICP27 homolog	Human herpesvirus 4 (Epstein Barr virus)	124	265
130694	1-O-(alpha-D-galactosyl)-N-hexacosanoylphytosphingosine			117	578
24786	HSLGKWLGHPDKF	Myelin proteolipid protein	Mus musculus (mouse)	113	693
130649	alpha-D-Galp-(1->3)-beta-D-Galp-(1->4)-D-GlcpNAc-yl group	Envelope glycoprotein	Murine leukemia virus	108	425
48237	PKYVKQNTLKLAT	Hemagglutinin	Influenza A virus	107	385
112742	2,4,6-trinitrophenyl group			106	309
6435	CINGVCWTV	Genome polyprotein	Hepatitis C virus	105	301
32208	KLVALGINAV	Genome polyprotein	Hepatitis C virus	95	281
53112	RAHYNIVTF	Protein E7	Alphapapillomavirus 9	94	236
61086	SSIEFARL	Envelope glycoprotein B	Human herpesvirus 1	93	305
61151	SSLENFRAYV	Polymerase acidic protein	Influenza A virus	87	263
16833	FLPSDFFPSV	Capsid protein	Hepatitis B virus	85	244
30001	KAVYNFATC	Pre-glycoprotein polyprotein GP complex	Lymphocytic choriomeningitis mammarenavirus	84	246
65748	TPRVTGGGAM	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)	84	172
6568	CLGGLLTMV	Latent membrane protein 2	Human herpesvirus 4 (Epstein Barr virus)	83	215
7493	DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA	Amyloid beta A4 protein	Homo sapiens (human)	81	254
16878					47

Search feature recapitulated
Enables refinement of initial query
Allows for more complex search using Finders (e.g. specific assay)
Allows for Specialized Searches (e.g. mAb by name)

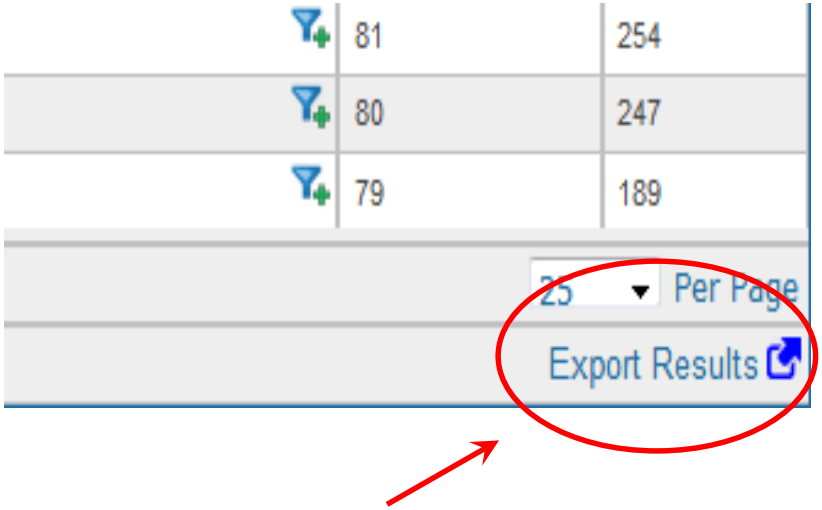
Exploring the Results Page







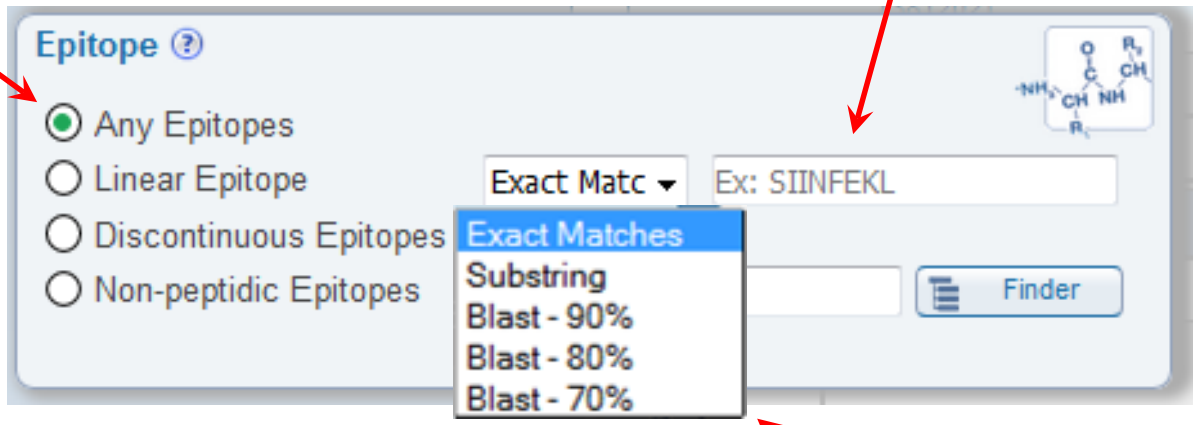
- **Current Filters** track query parameters along the top
- Export of data per tab is available in **Excel download**



Epitope Sequence Search

Default is '**Any**' which gives all epitope types

Can type in sequence of choice

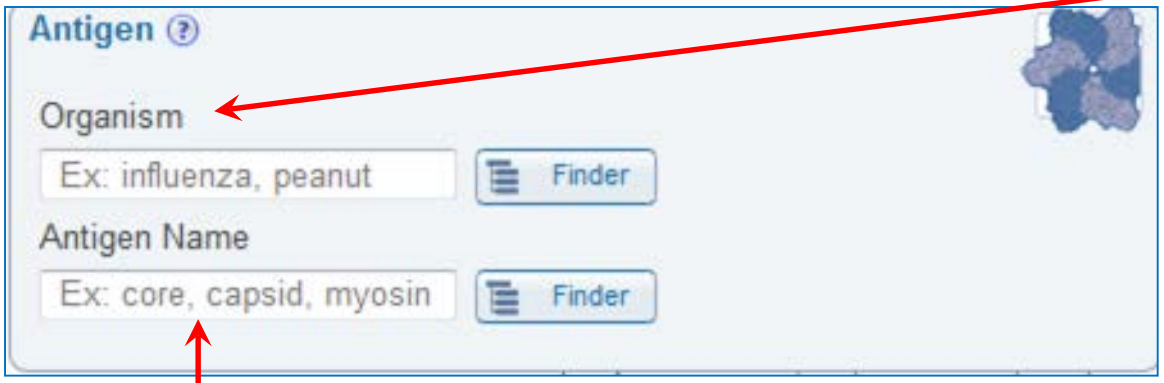


Use radio button to select specific type of structure

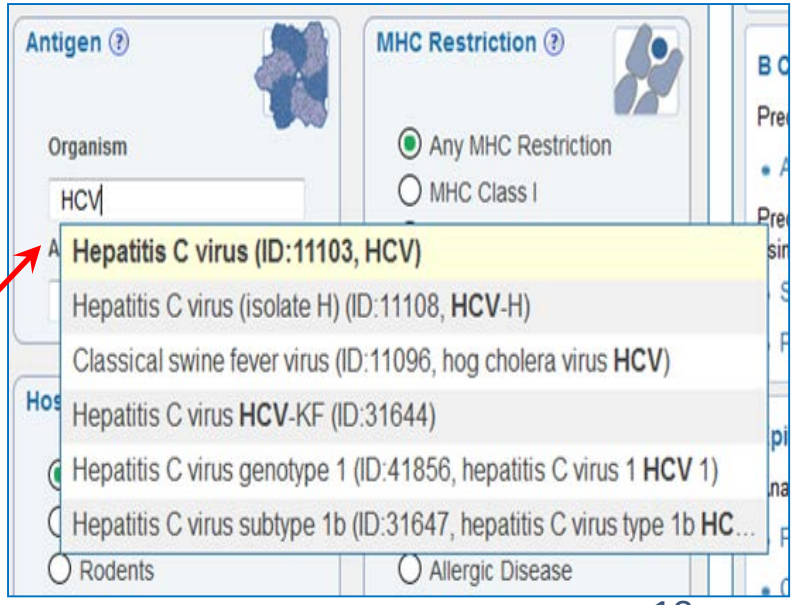
An search for **exact** or **homologous** results

Antigen Search

Pathogen (virus, bacteria)
Mammals (self-Ag)
Allergen source (grass)



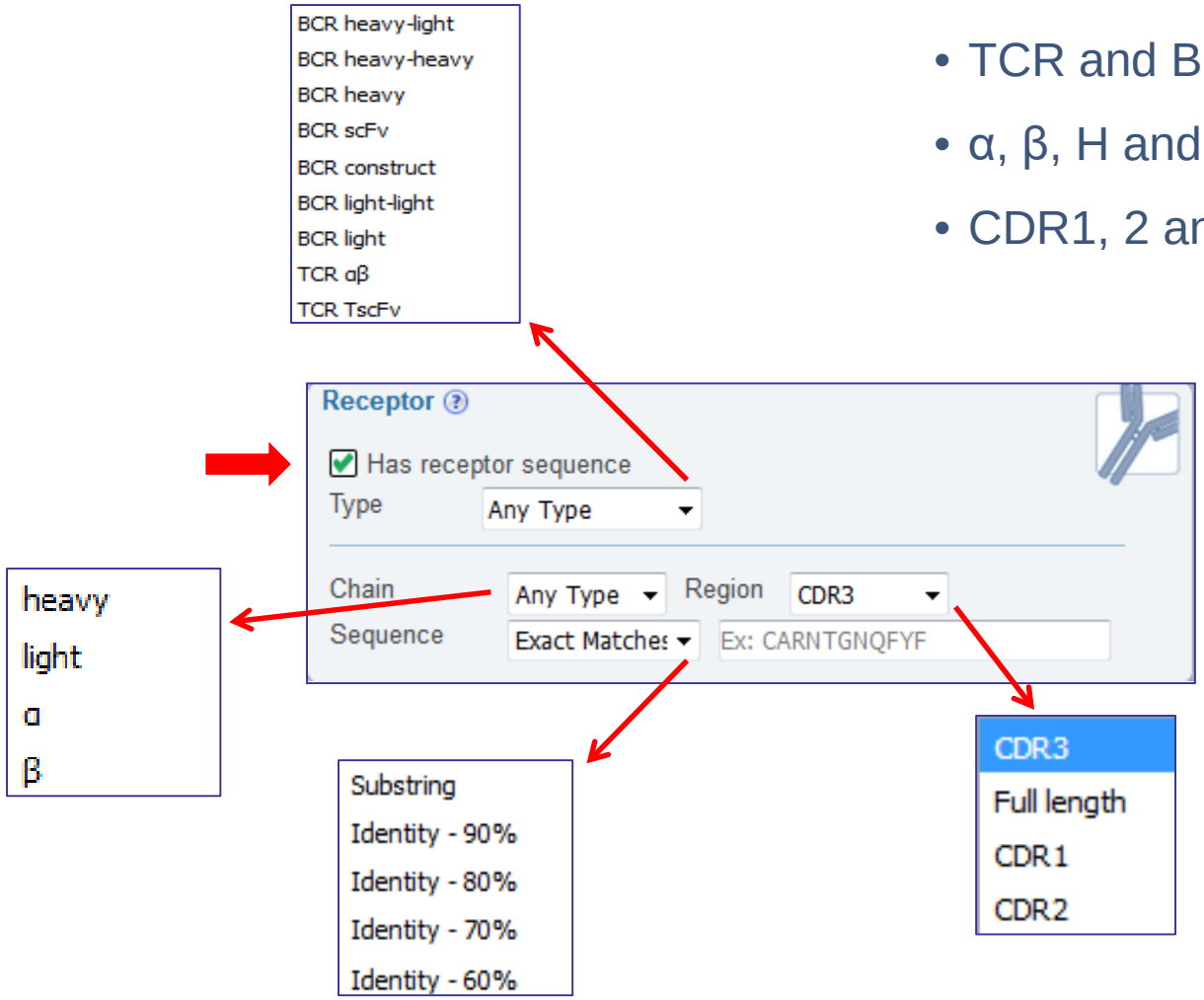
Protein of interest (source of epitope)



Click in field and start typing… auto-complete feature helps process

Receptor Data

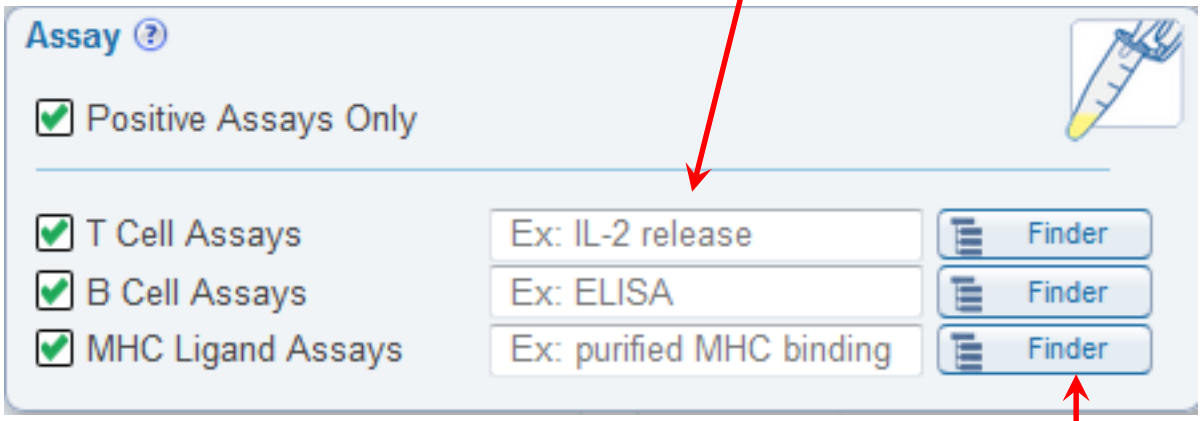
- TCR and BCR
- α, β, H and L
- CDR1, 2 and 3



Assay Search

Can type in assay of interest (auto-complete)

Select response type of interest at 'high level' by checking box



Default setting (must de-select):

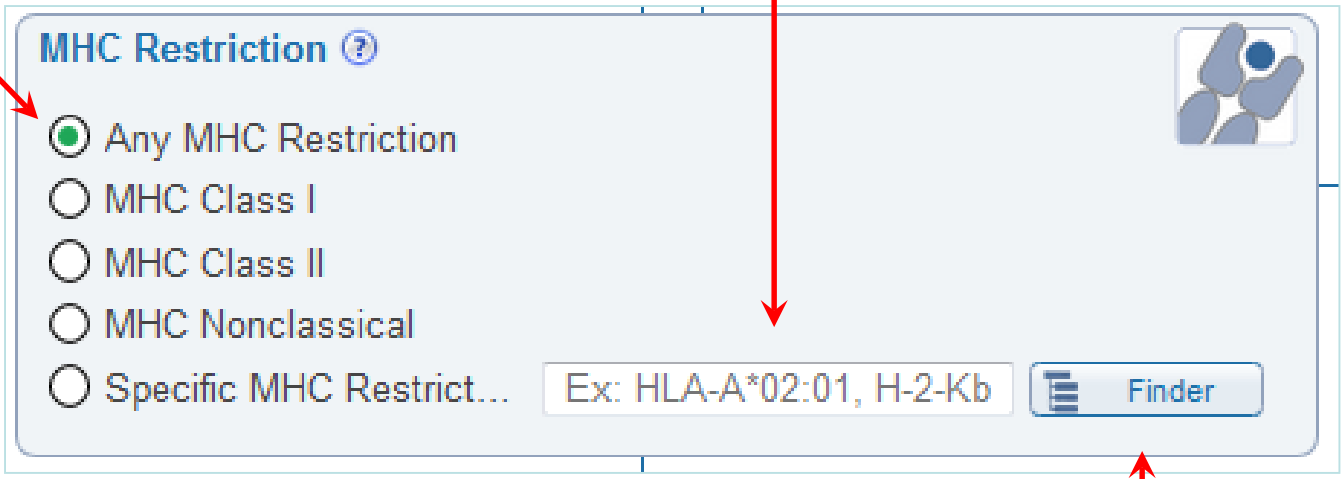
- 'All' assay types
- 'Positive only'

Click open **Finder** to access data tree if you cannot immediately find the one you want

MHC Restriction Search

Default searches all restrictions

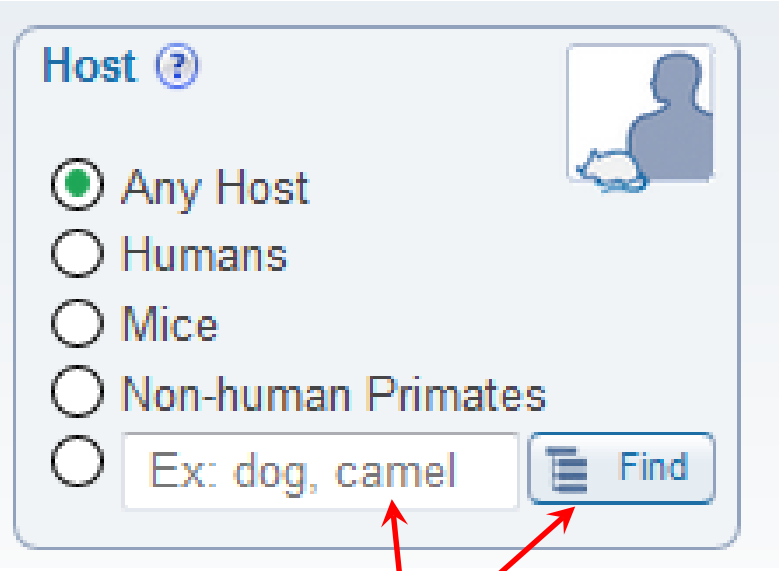
Use text box to find allele with auto-complete



Specify class

Use **Finder** to explore specific alleles

Host Search



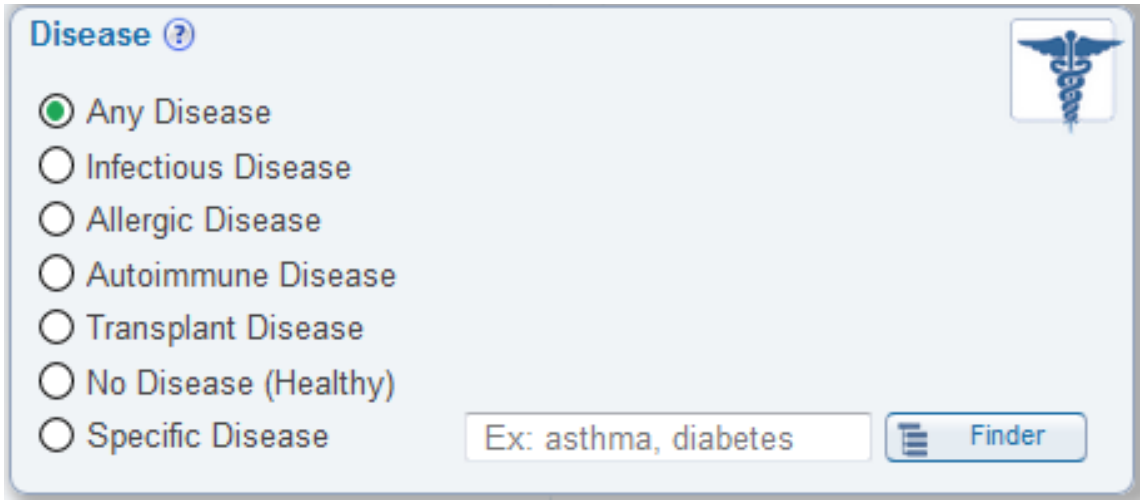
Search for host of interest
- Human data
- Animal models

Can use text box or **Finder** to select certain unique species

Search by Disease

Represents clinical status of a host:

- Patient history
- Known animal models of disease



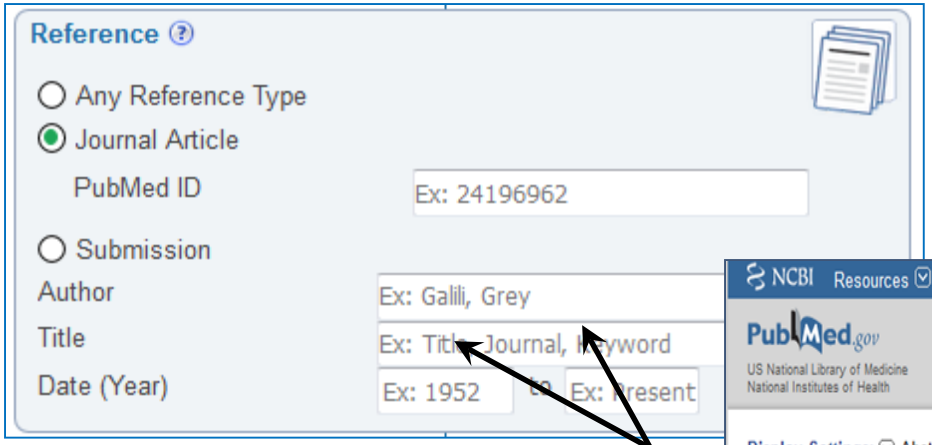
Unique feature

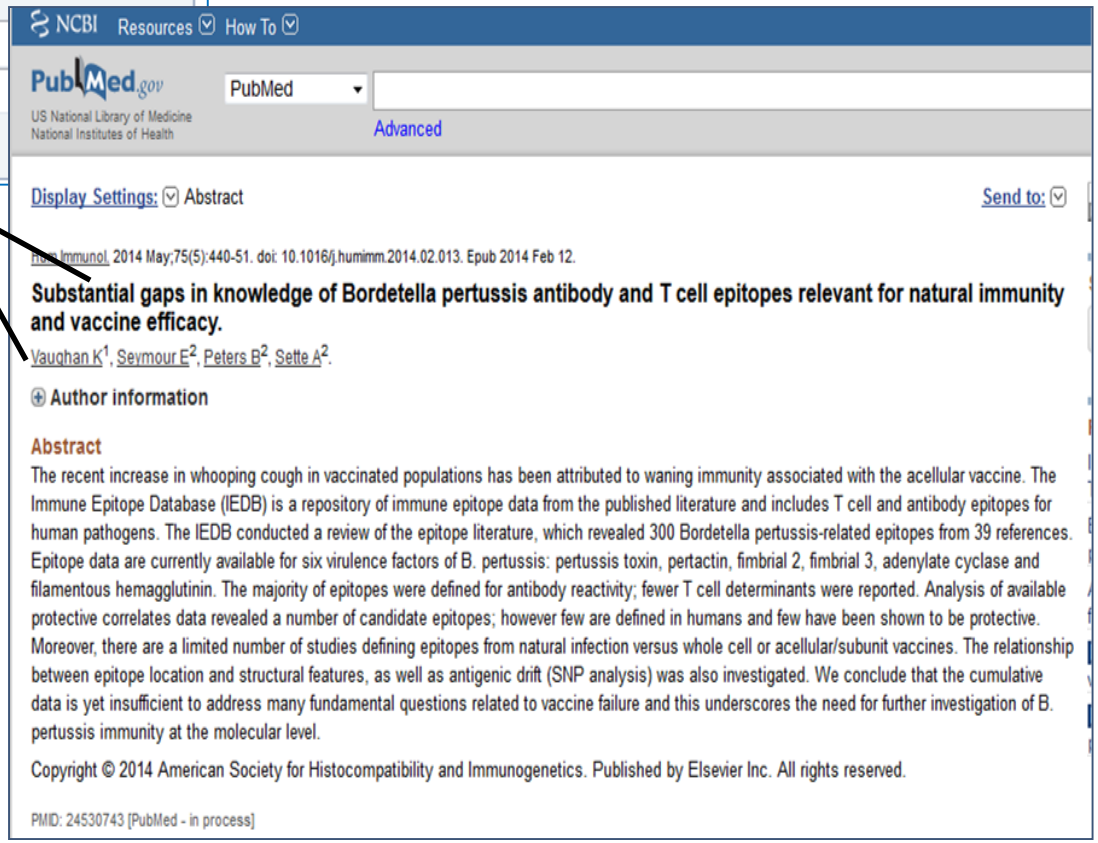
- Allergy
- Autoimmunity
- Healthy controls

Can assess differential reactivity

- Animal model v. human

Reference Search





Search for paper of interest….
By Author, PMID, etc.

Finders and Data Trees

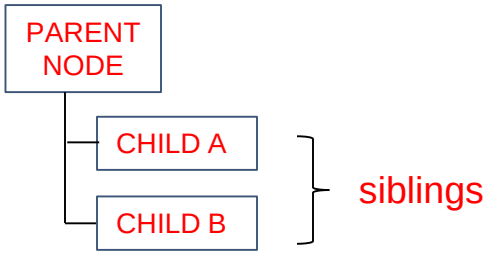
Finders

- unique feature of IEDB
- provide standardization and hierarchical organization
- search enormous amount of data using collapsible ‘data trees’
- enables big picture or granularity

Data tree

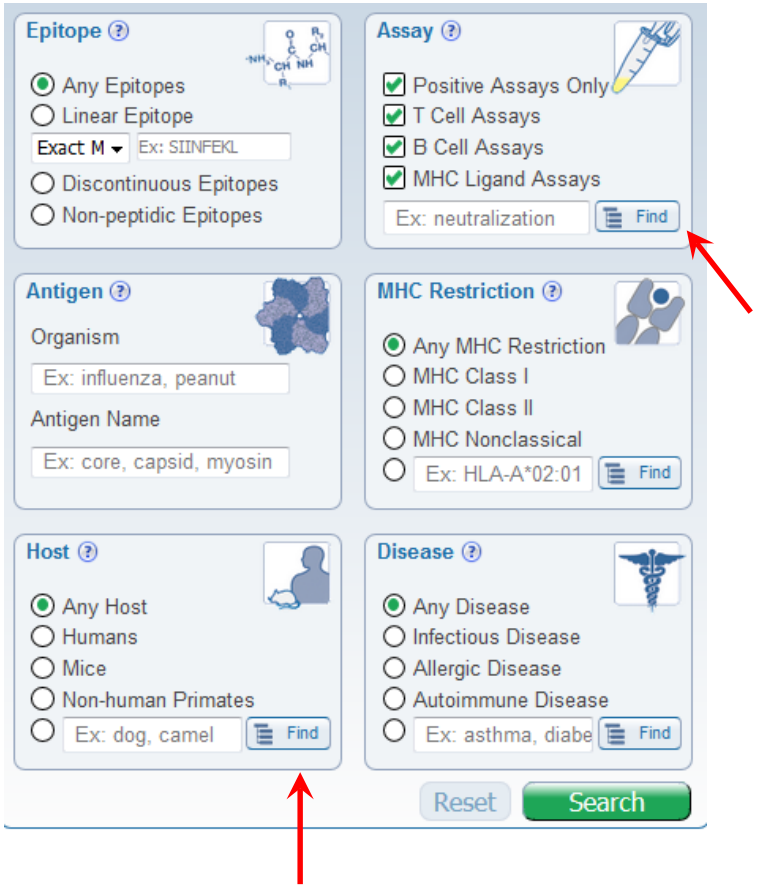
- ontological or taxonomical-based data organizer
- parent/child node relationships
- work ‘behinds the scenes’ and are accessible to the user
- used to organize:

Antigens (NCBI GenPept, SwissProt, PDB)
Non-proteins (ChEBI)
Organisms (NCBI taxonomy)
Alleles (MRO)
Assays (BAO)
Disease (Disease Ontology, DO ids)

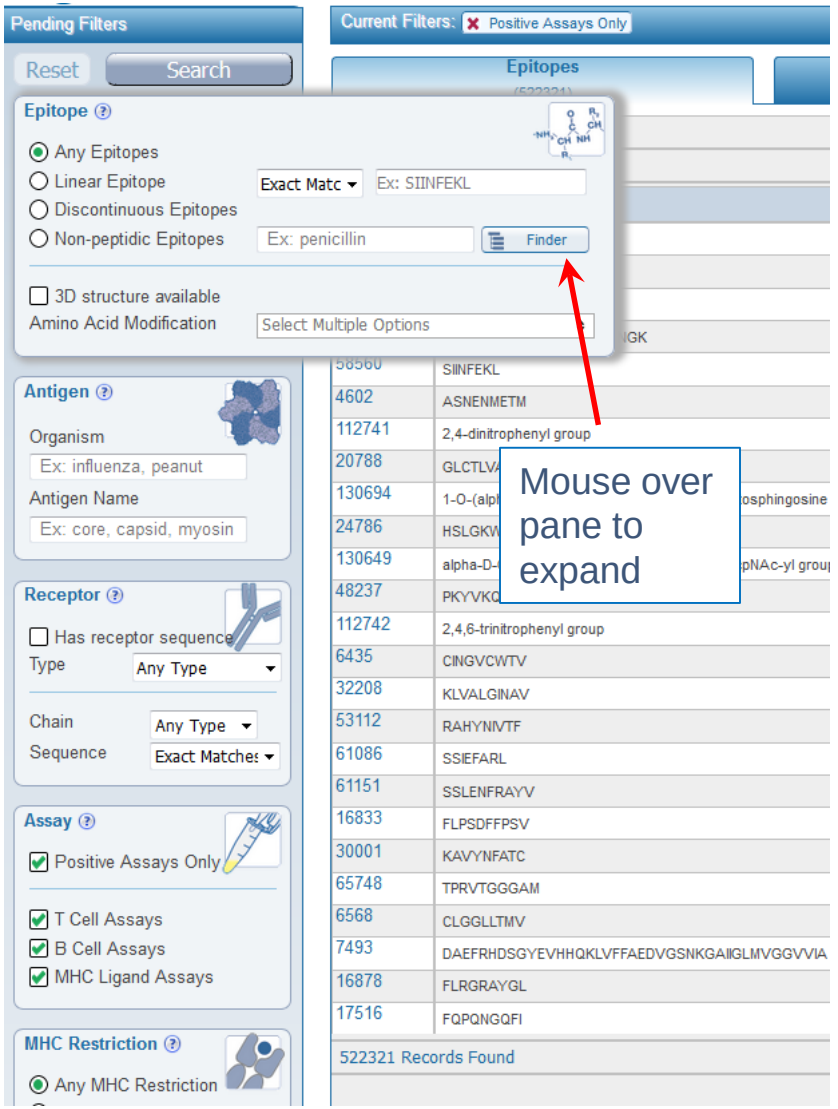


Accessing Finders

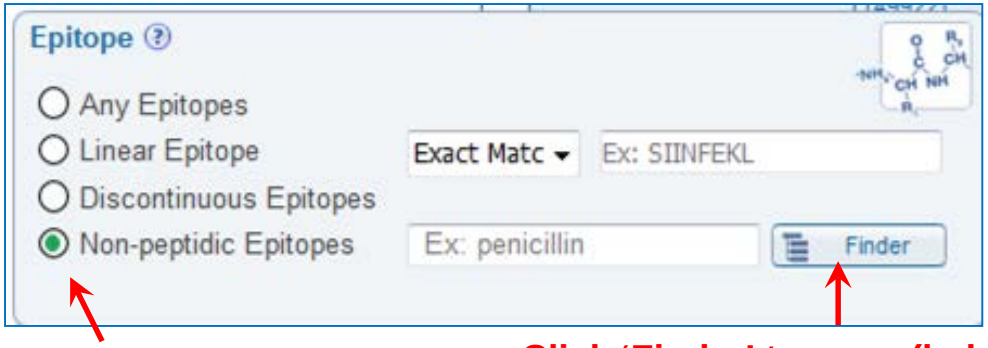
Home Page



Results Page



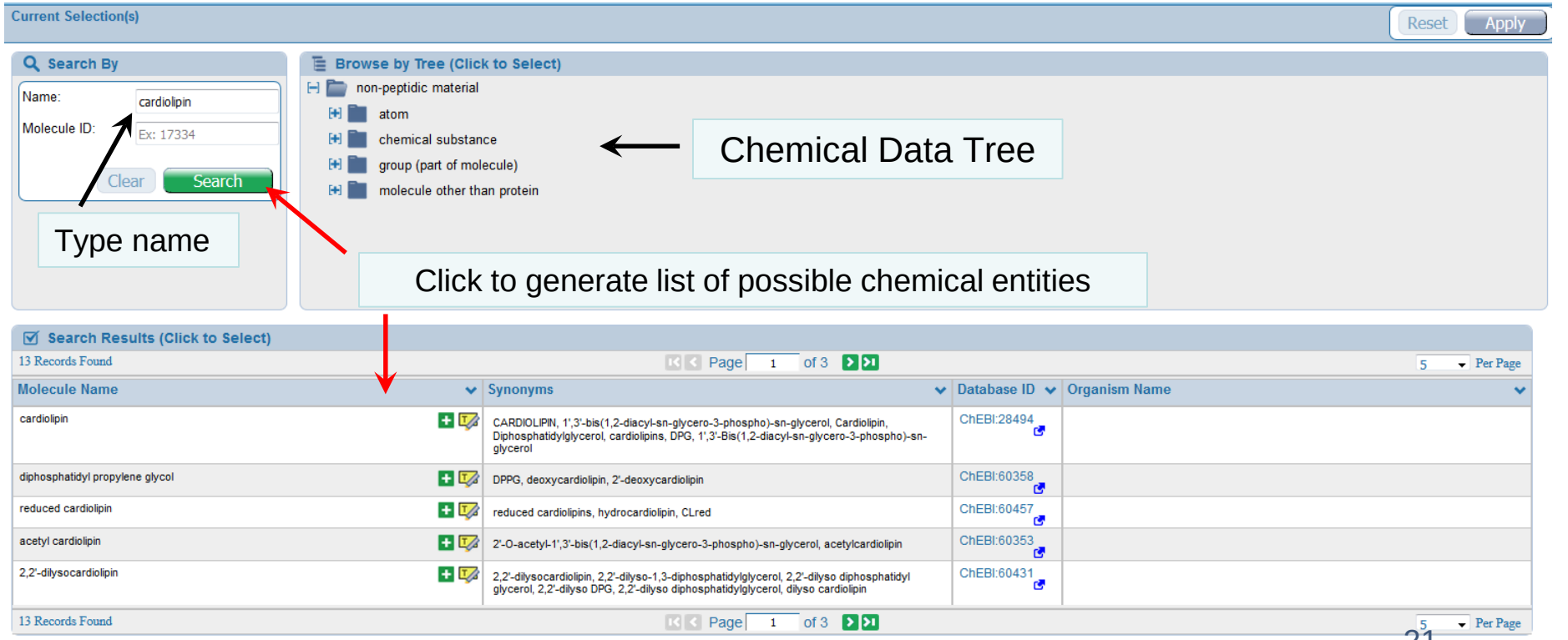
Non-Peptidic Epitope Finder



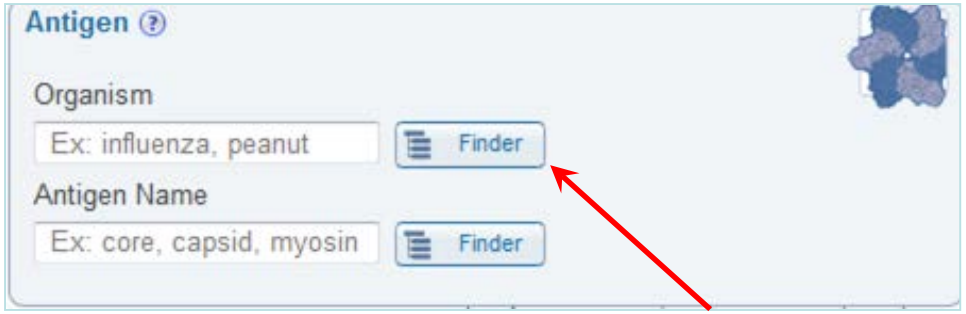
Click 'Finder' to open (below)

Non-protein chemical entities

- metal allergens
- drugs
- lipids, glycolipids, etc.



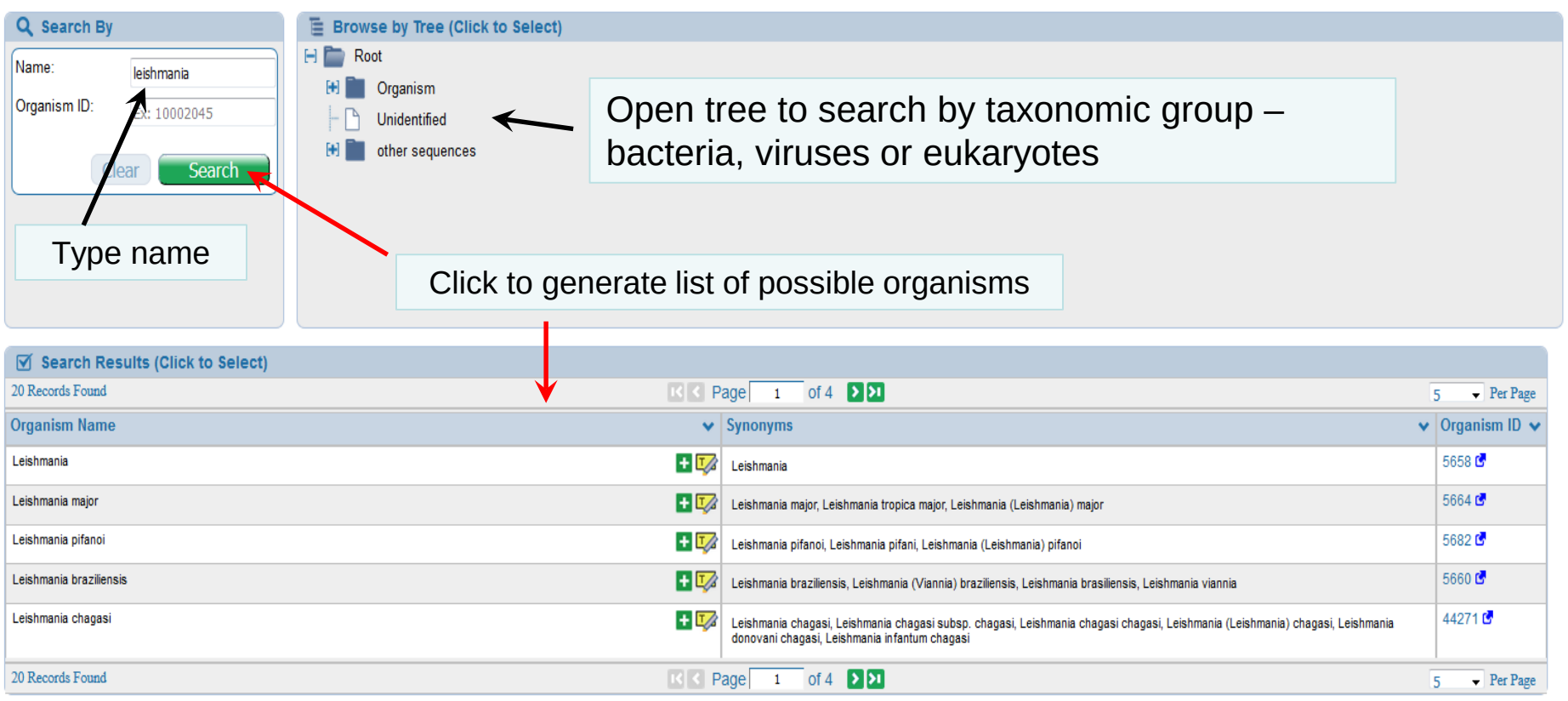
Organism Finder



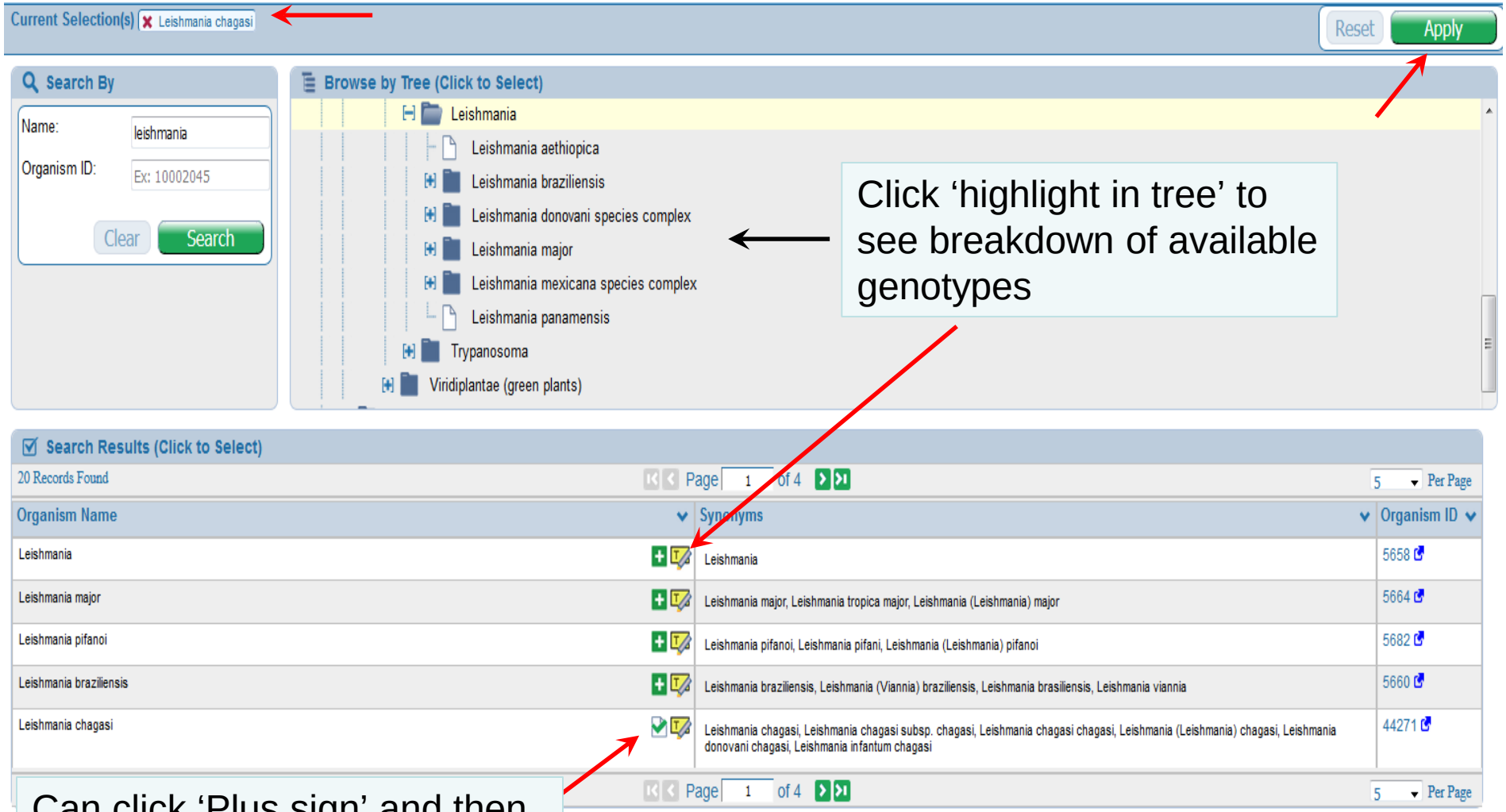
Links to NCBI taxonomy
Used to search for:

- epitope source
- immunogen if organism
- assay antigen

Click 'Finder' to open (below)

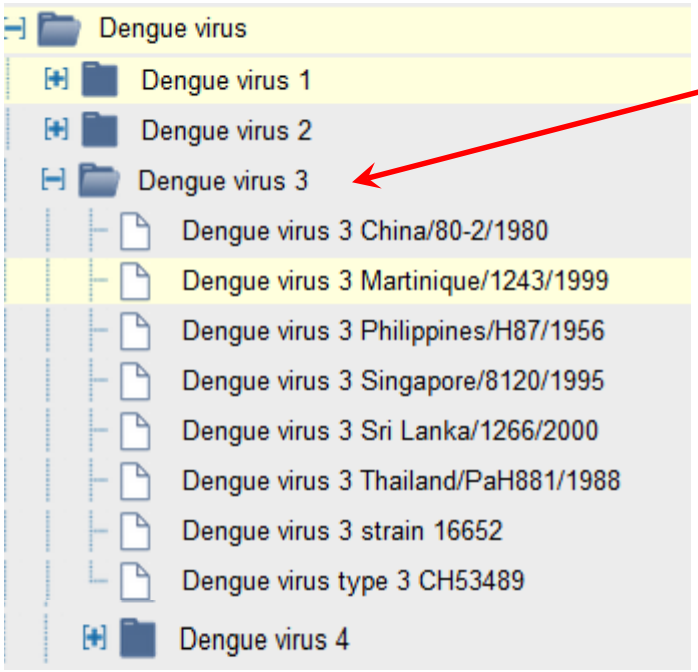


Organism Finder

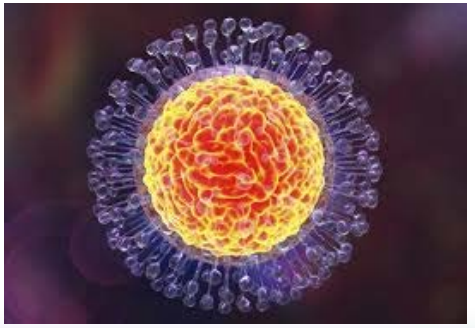


Can click 'Plus sign' and then Apply to add criteria from Current Selection(s)

Example of Organism Data Tree



Click to open successive nodes to find specific strain or use high node to look at all available

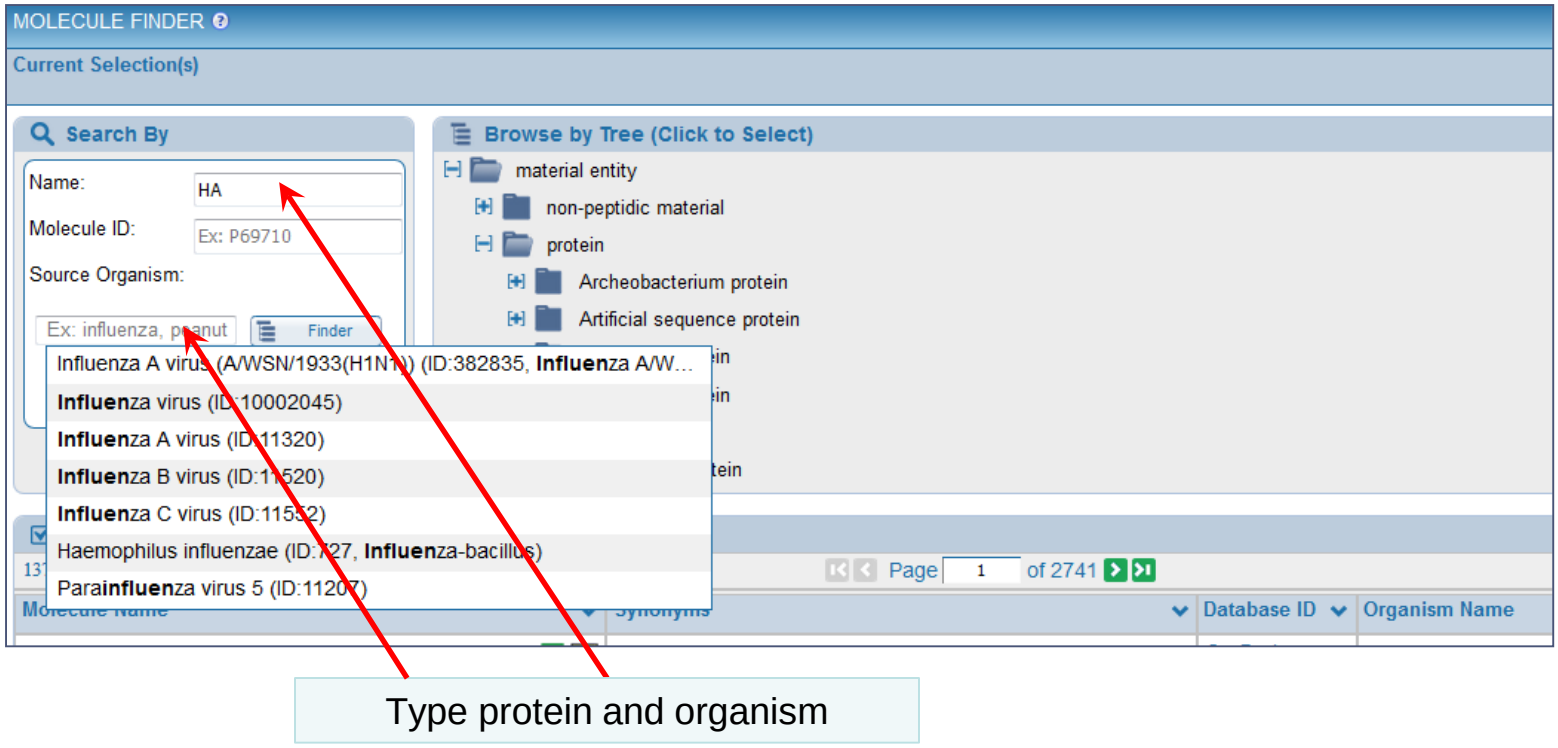


Antigen Finder

Links to NCBI GenPept
Used to search for:

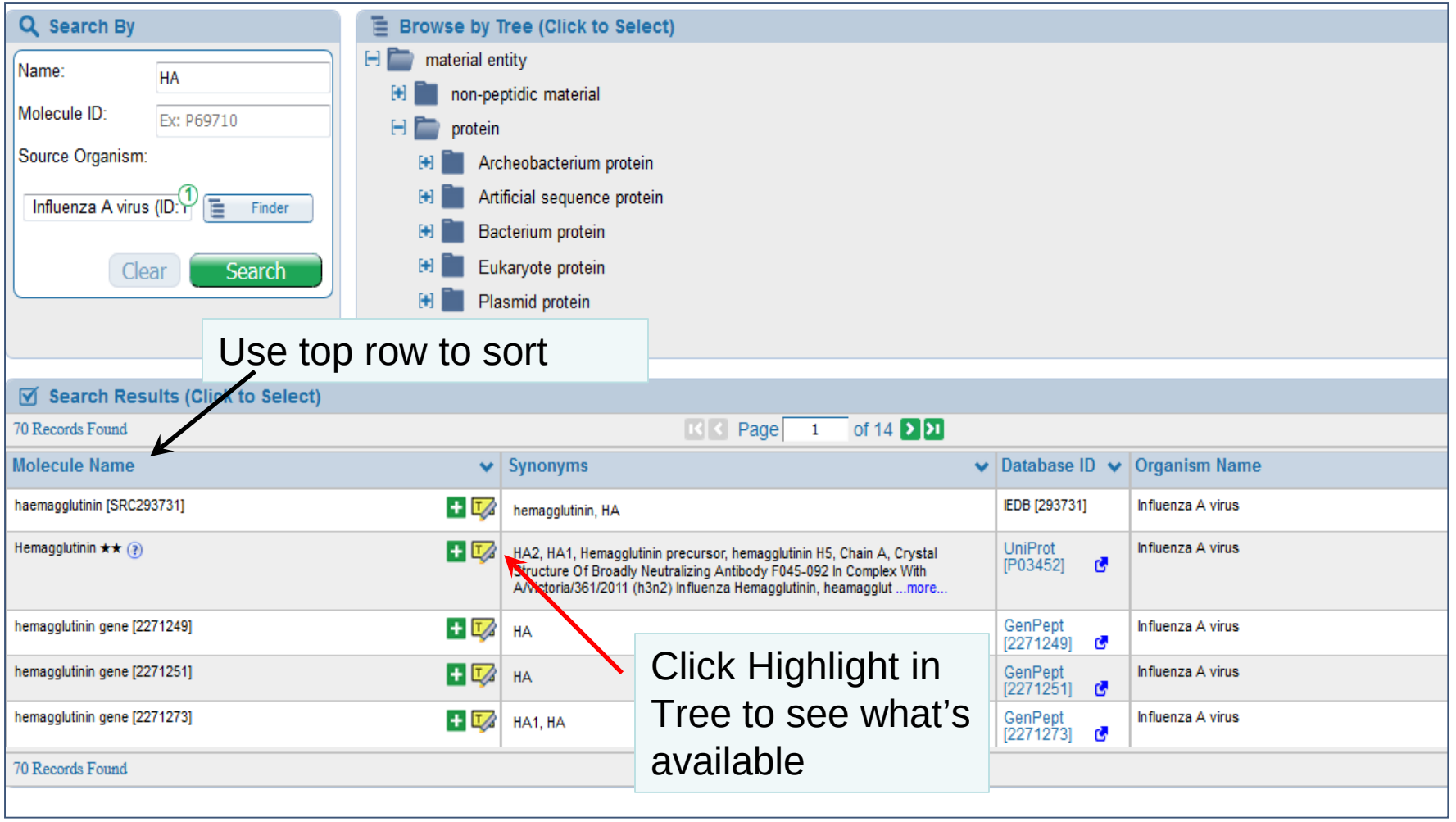
- epitope source
- immunogen if protein
- assay antigen source

Click 'Finder' to open (below)



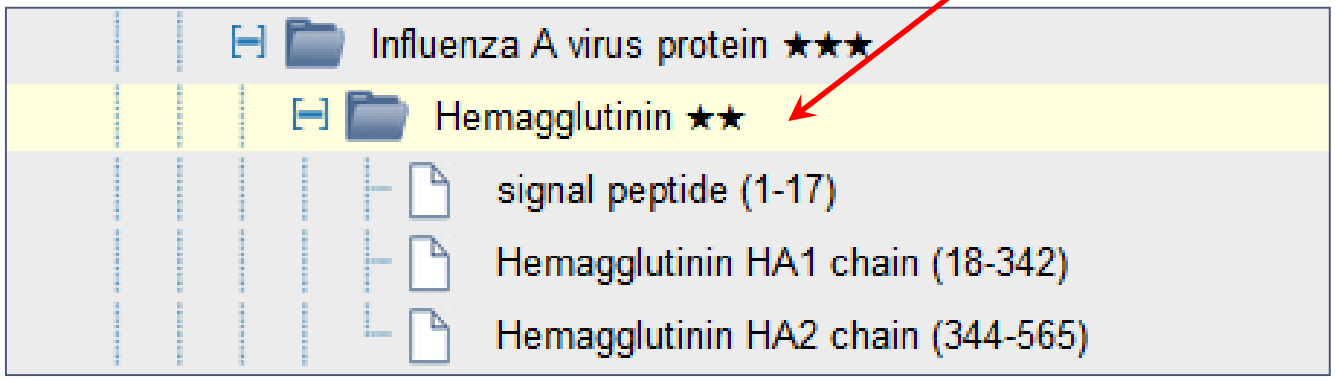
Type protein and organism

Antigen Finder

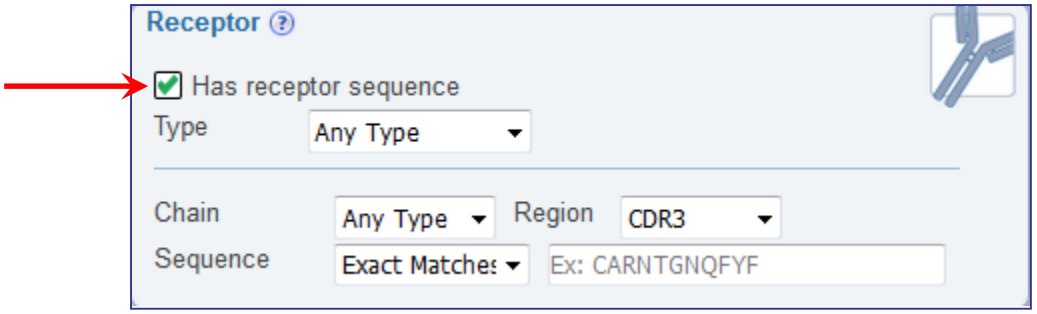


Example of Antigen Tree

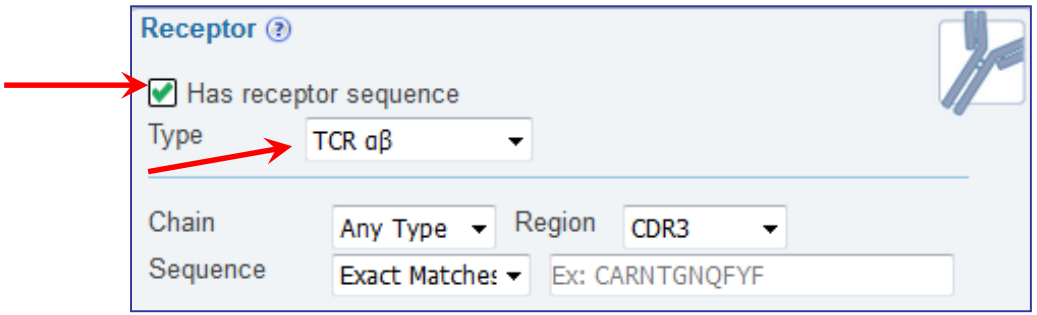
Click high node ‘Hemagglutinin’ to retrieve **all** HA from all flu



Receptors search (no finder)



18,292 total



16,948 TCRαβ

Receptors results summary

Epitopes (522321) | Receptors (18292)

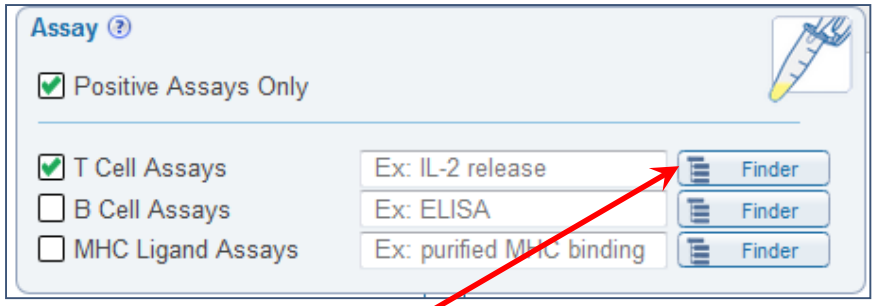
T Cell Receptors (16949) | B Cell Receptors (1343)

Go To

16949 Records Found

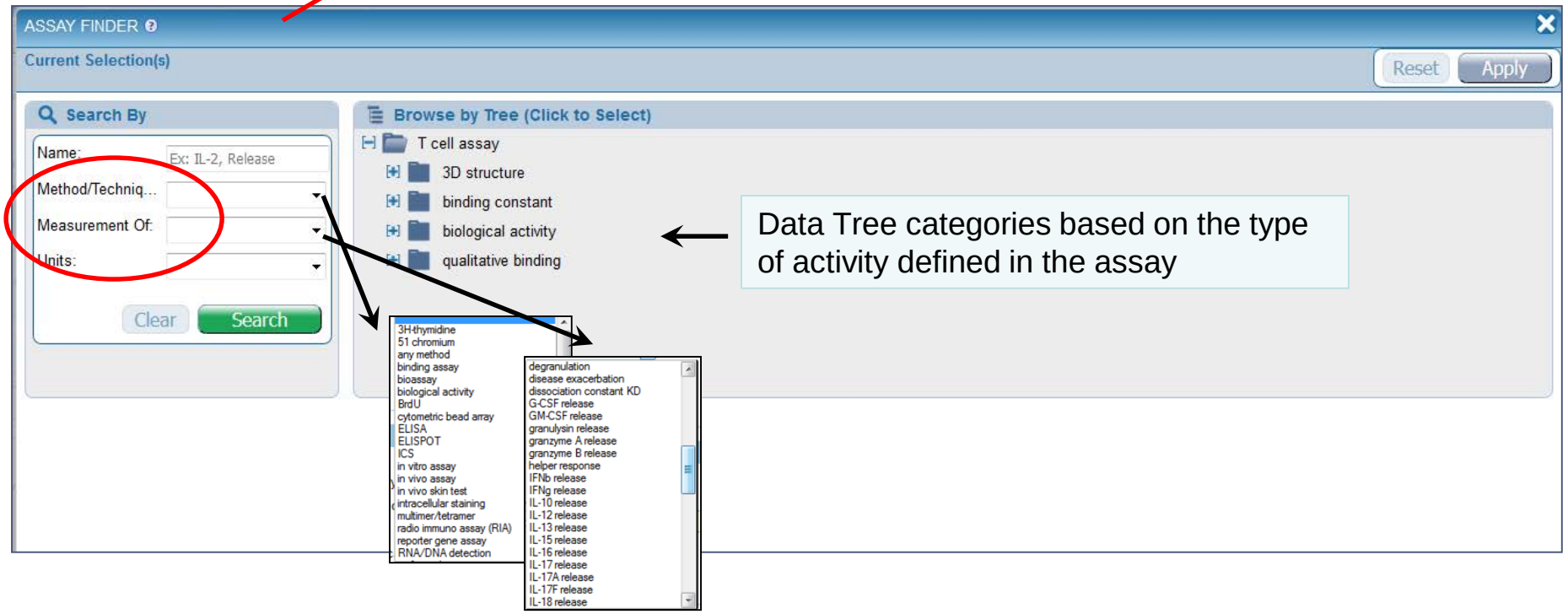
Group ID	Species	Type	Chain 1 CDR3	Chain 2 CDR3
47	Homo sapiens (human)	αβ	IVVRSSNTGKLI	ASSQDRDTQY
49	Mus musculus (mouse)	αβ	AASANSGTYQR	ASGDAGGGYEQY
50	Mus musculus C57BL/6	αβ	AAS	ASSL
57	Homo sapiens (human)	αβ	AALIQGAQKLV	ASTYHGTGY
94	Homo sapiens (human)	αβ	AVRPLLDGTYIPT	ASSYLGNTGELF
102	Mus musculus (mouse)	αβ	ALSENYGNEKIT	ASGDASGAETLY
103	Mus musculus (mouse)	αβ	ALSENYGNEKIT	ASGDASGGNTLY
104	Mus musculus (mouse)	αβ	AANSGTYQR	ASGDFWGDTLY
109	Homo sapiens (human)	αβ	IVWGGYQKVT	ASRYRDDSYNEQF
110	Homo sapiens (human)	αβ	AVTTDSWGKLQ	ASRPGLAGGRPEQY
111	Homo sapiens (human)	αβ	AVTTDSWGKLQ	ASRPGLMSAQPEQY
114	Mus musculus (mouse)	αβ	AVSDPPPLLT	ASGGGGTLY
115	Mus musculus (mouse)	αβ	AVSLERPYLT	ASGGGGTLY
116	Homo sapiens (human)	αβ	ALSGFYNTDKLI	ASPGLAGEYEQY
117	Homo sapiens (human)	αβ	AVRPTSGGSYIPT	ASSYVGNTGELF
118	Mus musculus (mouse)	αβ	ALFLASSSFSKLV	ASSDWVSYEQY
125	Homo sapiens (human)	αβ	ATDTTSGTYKYI	SARDLTSGANNEQF

Assay Finder



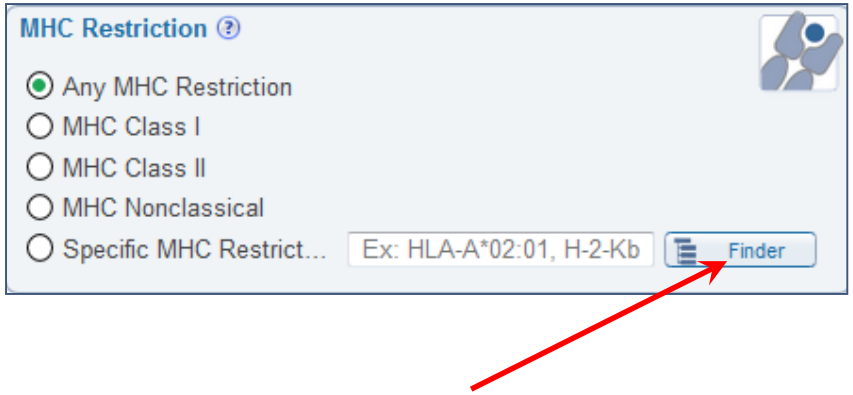
Find specific assay within broader category

- Neutralization
- Cytolysis (BrdU v. ^{51}Cr)
- IFNγ ELISPOT



Data Tree categories based on the type of activity defined in the assay

Allele Finder

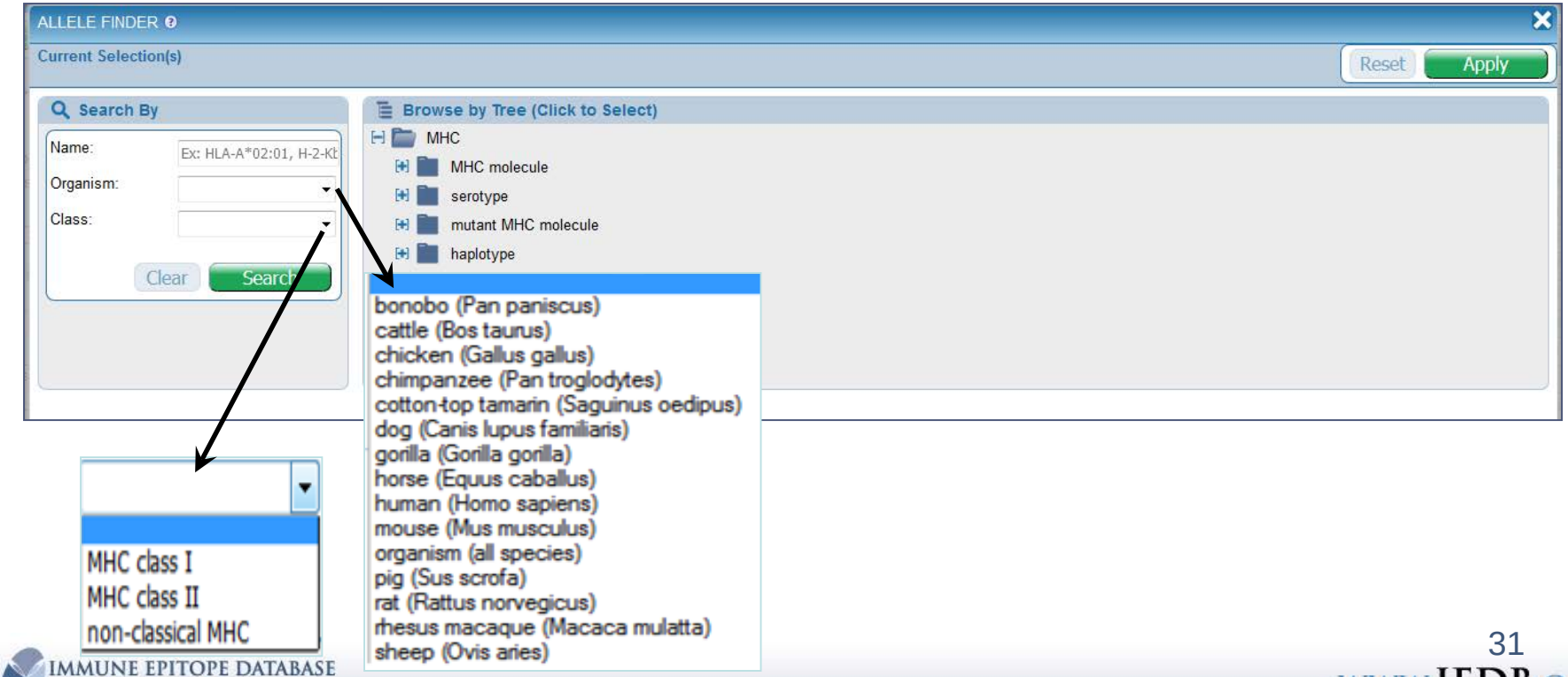


MHC restriction defined in assay

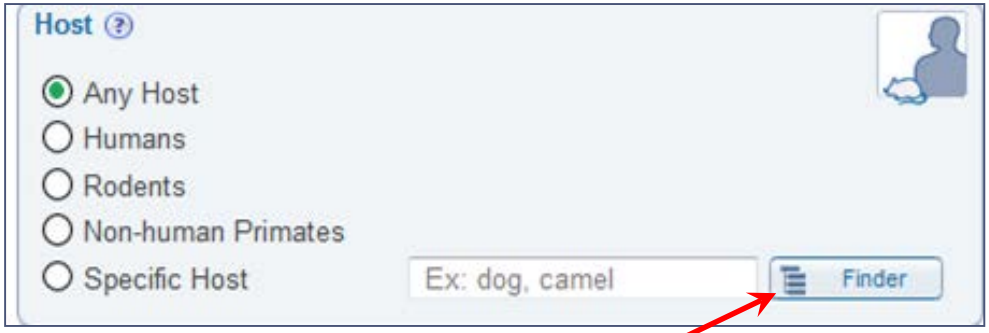
Alleles from 16 species

Search at level of:

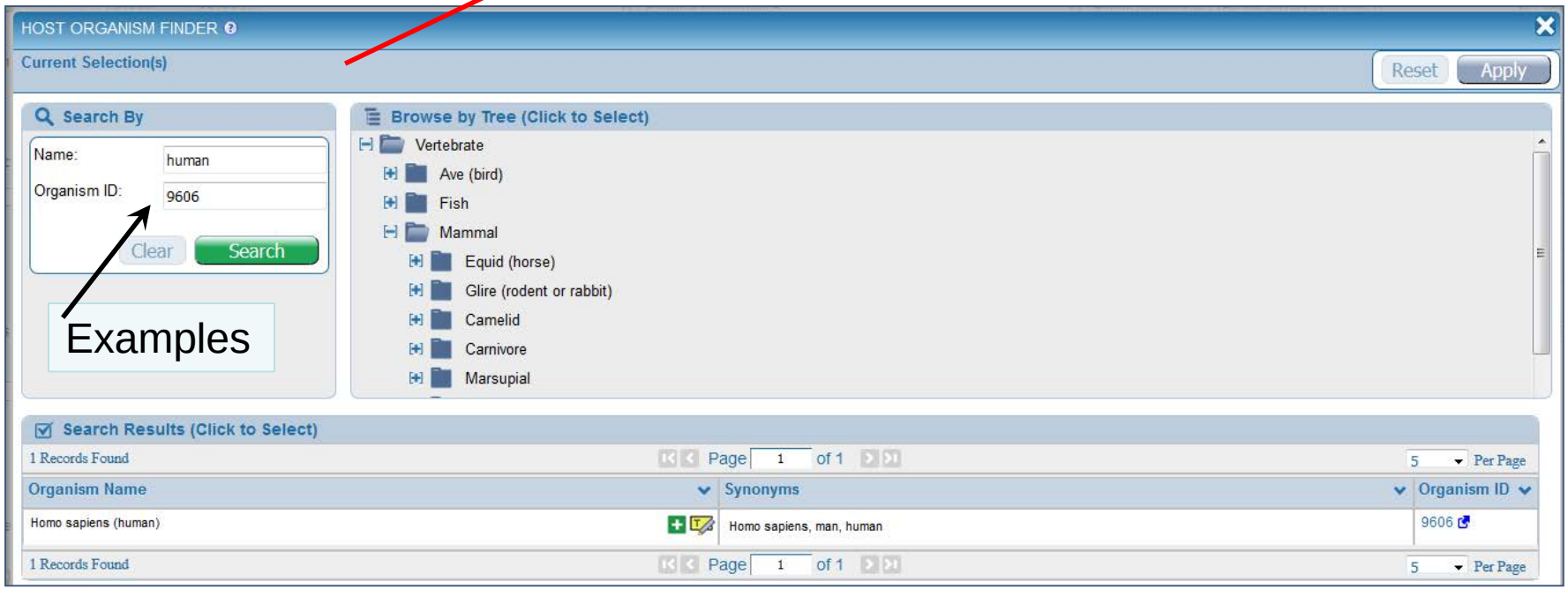
- Species
- Class
- Serotype
- Allele



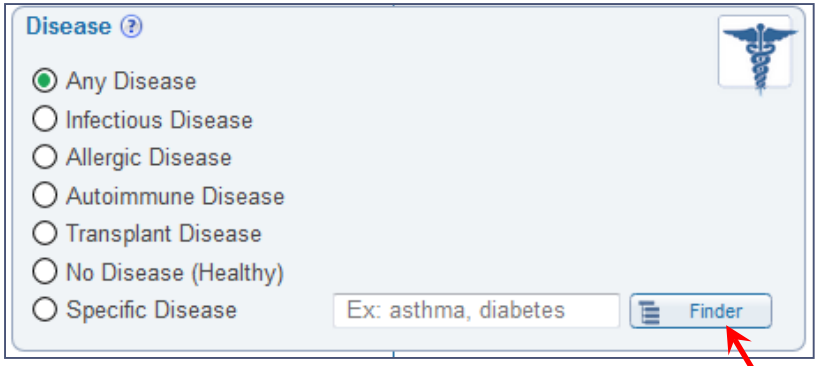
Host Finder



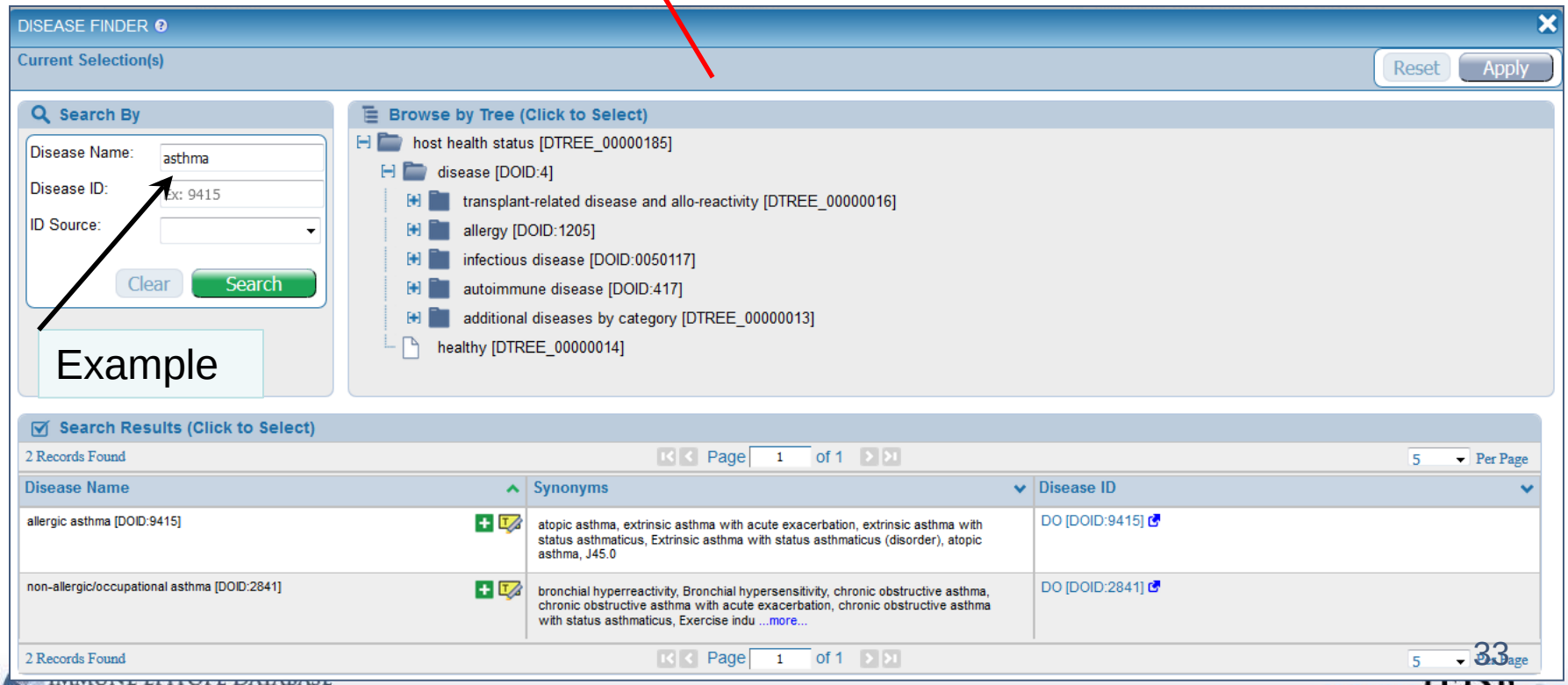
Subject or *animal model* in which the immune response was defined



Disease Finder



- 4 Broad disease categories
- Specific disease types (RA, asthma)
- Includes animal models (e.g. EAE)
- Easy way to find data for non-infectious disease (AI)

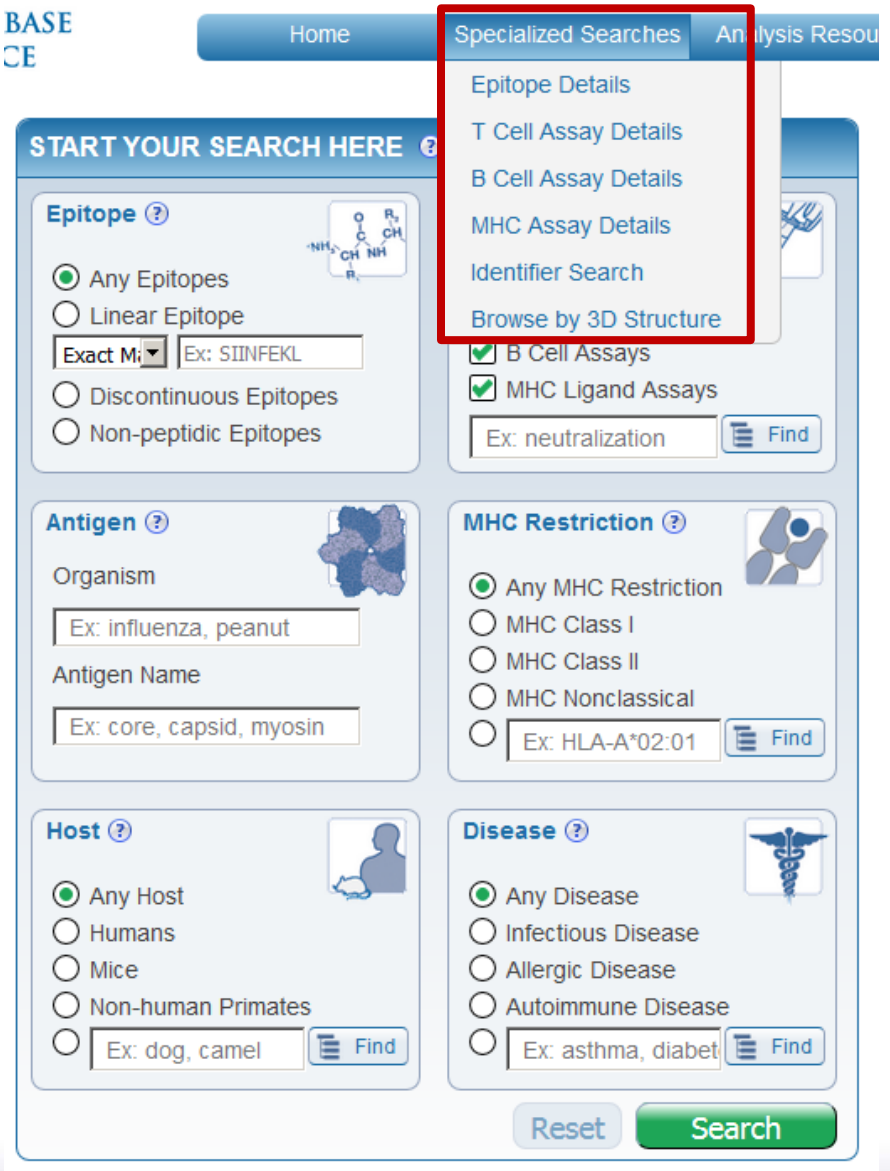


Specialized Searches

1. "Details" searches
   - Search all database fields
   - Formulate more specific queries

2. Identifier search
   - Query using unique IDs

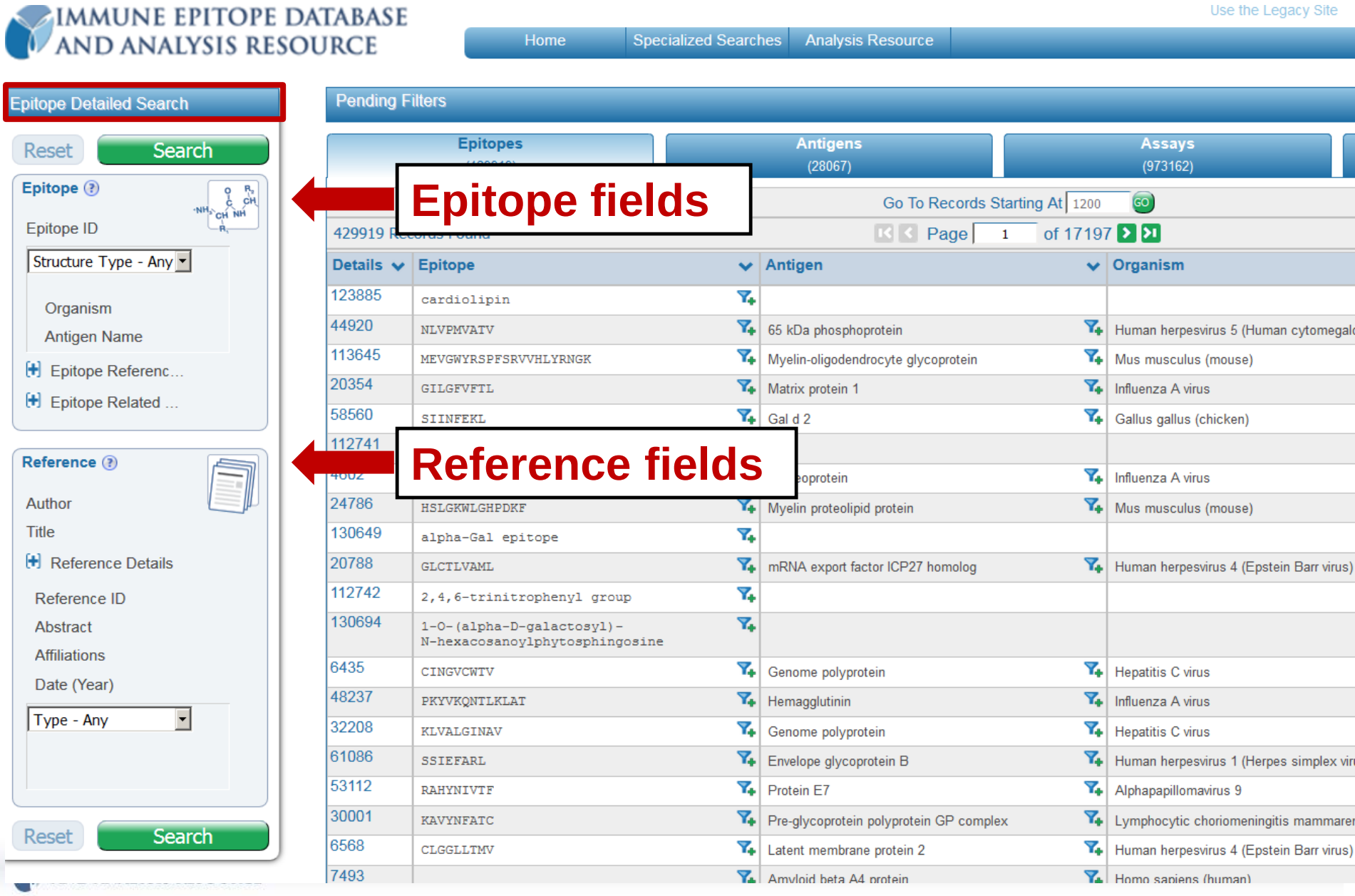
3. Browse by 3D Structure
   - Structural data organized in a tree

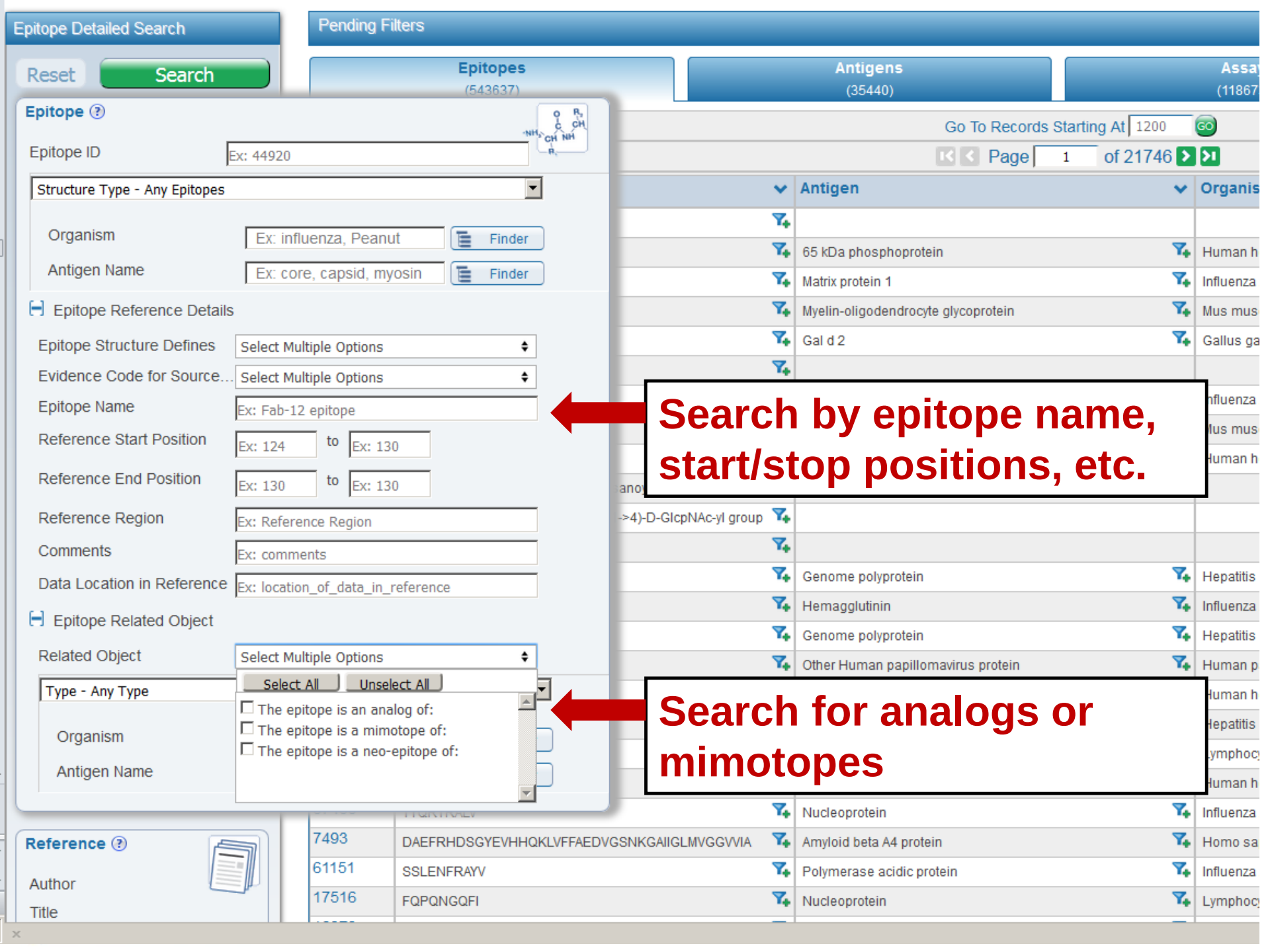


Examples of Homepage vs. Details Search Capabilities

Query	Homepage	Details
Sequence	✔	✔
Source antigen	✔	✔
Source organism	✔	✔
MHC class	✔	✔
MHC allele	✔	✔
Host strain	✔	✔
Specific assay type	✔	✔
Immunized vs. naturally infected		✔
Immunogen/Antigen		✔
Effector cell type/Antibody isotype		✔

Specialized Search – Epitope Details




Epitope Detailed Search
Reset
Search
Epitope
Epitope ID
Ex: 44920
Structure Type - Any Epitopes
Organism
Ex: influenza, Peanut
Finder
Antigen Name
Ex: core, capsid, myosin
Finder
Epitope Reference Details
Epitope Structure Defines
Select Multiple Options
Evidence Code for Source...
Select Multiple Options
Epitope Name
Ex: Fab-12 epitope
Reference Start Position
Ex: 124
to
Ex: 130
Reference End Position
Ex: 130
to
Ex: 130
Reference Region
Ex: Reference Region
Comments
Ex: comments
Data Location in Reference
Ex: location_of_data_in_reference
Epitope Related Object
Related Object
Select Multiple Options
Select All
Unselect All
Type - Any Type
The epitope is an analog of:
The epitope is a mimotope of:
The epitope is a neo-epitope of:
Organism
Antigen Name
Reference
Author
Title
Pending Filters
Epitopes
(543637)
Antigens
(35440)
Go To Records Starting At
1200
GO
Page
1
of 21746
Antigen
Organis
65 kDa phosphoprotein
Human h
Matrix protein 1
Influenza
Myelin-oligodendrocyte glycoprotein
Mus mus
Gal d 2
Gallus ga
Genome polyprotein
Hepatitis
Hemagglutinin
Influenza
Genome polyprotein
Hepatitis
Other Human papillomavirus protein
Human p
Nucleoprotein
Influenza
7493
DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA
Amyloid beta A4 protein
Homo sa
61151
SSLENFRAYV
Polymerase acidic protein
Influenza
17516
FQPQNGQFI
Nucleoprotein
Lymphocy
Search by epitope name, start/stop positions, etc.
Search for analogs or mimotopes

An Example Analog Epitope

Epitope	
Epitope ID	107004
Chemical Type	Linear peptide
Linear Sequence	YAKQATLALA

Sequence studied

Epitope Reference Details	
Epitope Structure Defines	Exact Epitope
Epitope Name	aHAP (308–317)
Location of Data in Reference	Materials and Methods

Epitope Related Object	
Related Object Type	The epitope is an analog of:
Chemical Type	Linear peptide
Linear Sequence	YVKQNTLKLA
Starting Position	308
Ending Position	317
Source Molecule Name	hemagglutinin HA1
Source Accession	223282
Source Organism ID	11320
Source Organism	Influenza A virus

Natural analog of the sequence studied

Antigen Name

Epitope Referenc...

Epitope Structure Defines

Evidence Code for Source...

Epitope Name

Reference Start Position

Reference End Position

Reference Region

Comments

Data Location in Reference

Epitope Related ...

113645	MEVGWYRSPFSRVVHLYRNGK	Myelin-oligodendrocyte glycoprotein	Mus mus
20354	GILGFVFTL	Matrix protein 1	Influenza
58560	SIINFEKL	Gal d 2	Gallus g
112741	2,4-dinitrophenyl group		
4602	ASNENMETM	Nucleoprotein	Influenza
24786	HSLGKWLGHPDKF	Myelin proteolipid protein	Mus mus
130649	alpha-Gal epitope		
20788	GLCTLVAML	mRNA export factor ICP27 homolog	Human h
112742	2,4,6-trinitrophenyl group		
130694	1-O-(alpha-D-galactosyl)-N-hexacosanoylphytosphingosine		
6435	CINGVCWTV	Genome polyprotein	Hepatitis
		Hemagglutinin	Influenza
		Genome polyprotein	Hepatitis
		Envelope glycoprotein B	Human h
		Protein E7	Alphapa
		Pre-glycoprotein polyprotein GP complex	Lymphoc
		Latent membrane protein 2	Human h
		Polymerase acidic protein	Influenza
		Nucleoprotein	Lymphoc
		Epstein-Barr nuclear antigen 3	Human h

Reference

Author — Ex: Galili, Grey

Title — Ex: Title, Journal, Keyword

Reference Details

Reference ID — Ex: 315120

Abstract — Ex: escape mutant

Affiliations — Ex: National Jewish

Date (Year) — Ex: 1952 to Ex: Present

Type - Any
- Type - Any
- Type - Journal Article
- Type - Submission

Reset | Search

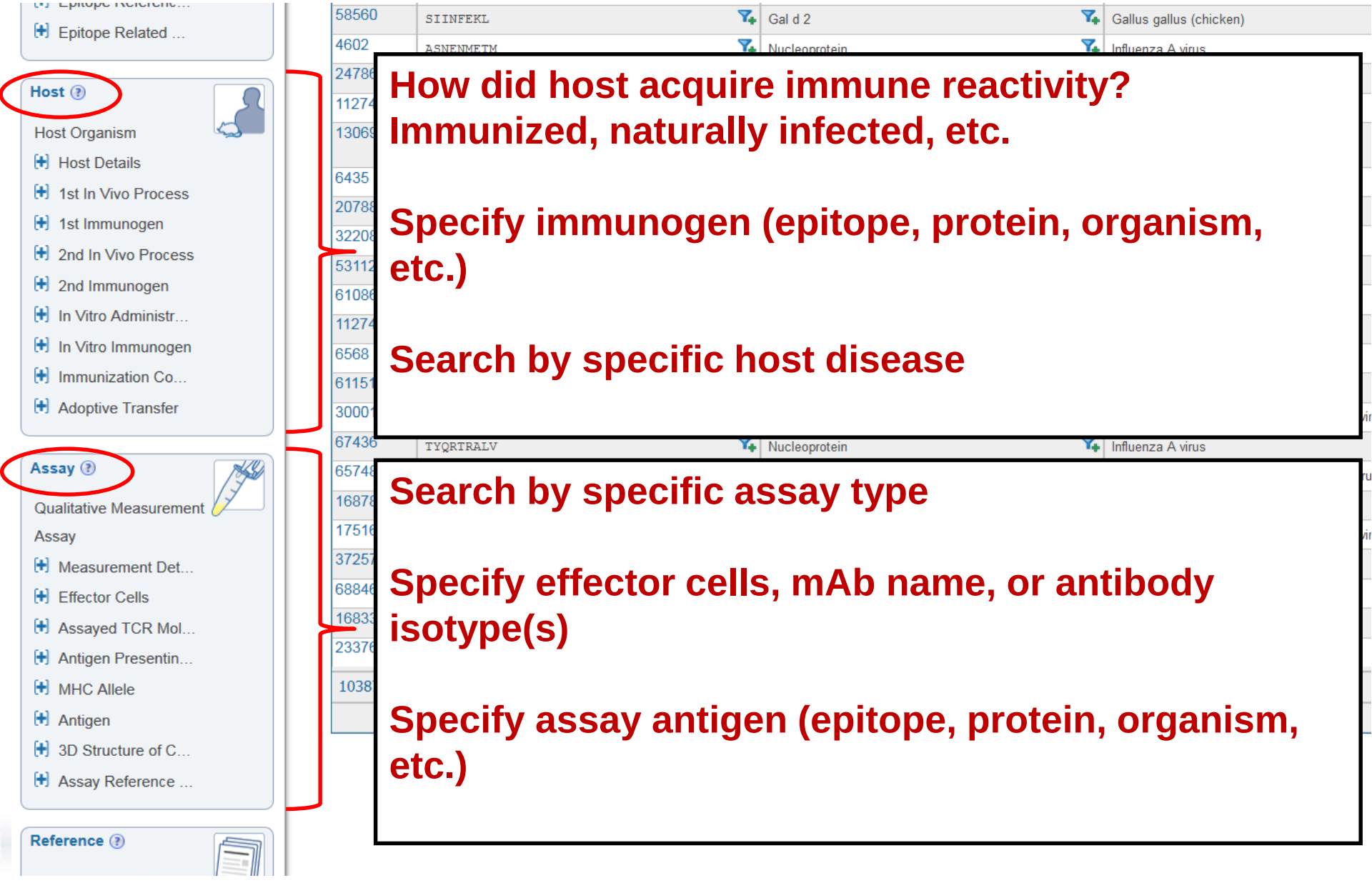
Search by author(s), journal, etc.

429919 Records Found

Page 1 of 17197

Go To Records Starting At 1200 GO

Specialized Search –Assay Details (T, B, MHC)



Assay Details – In Vivo Processes

Structure Type - Any

Organism

Antigen Name

Epitope Referenc…

Epitope Related …

Host

Host Organism — Ex: dog, camel — Finder

Host Details

1st In Vivo Process

1st Immunogen

2nd In Vivo Process

2nd Immunogen

In Vitro Administration

In Vitro Immunogen

Immunization Comments

Adoptive Transfer

Assay

Qualitative Measurement

Assay

Measurement Det…

Effector Cells

Assayed TCR Mol…

Antigen Presentin…

MHC Allele

Antigen

3D Structure of C…

Assay Reference …

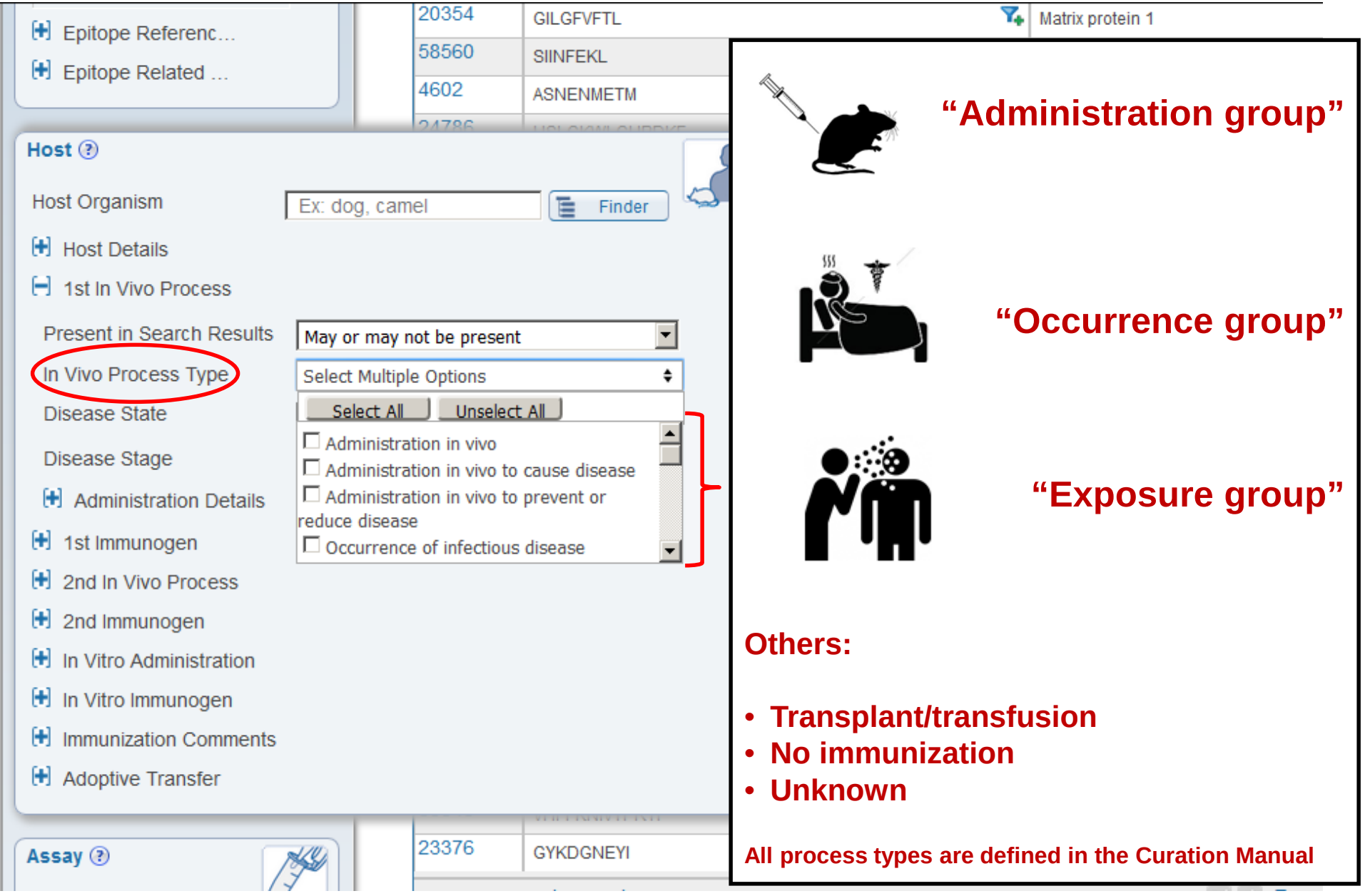
Reference

Details	Epitope	Antigen	Organism
44920	NLVPMVATV	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)
113645	MEVGWYRSPFSRVVHLYRNGK	Myelin-oligodendrocyte glycoprotein	Mus musculus (mouse)
20354	GILGFVFTL		
58560	SIINFEKL		
4602	ASNENMETM		
67436	TYQRTRALV		
16878	FLRGRAYGL		
17516	FQPQNGQFI		
16833	FLPSDFFPSV		
37257	LLFGYPVYV		
68846	VHFFKNIVTPRTP		
23376	GYKDGNEYI		

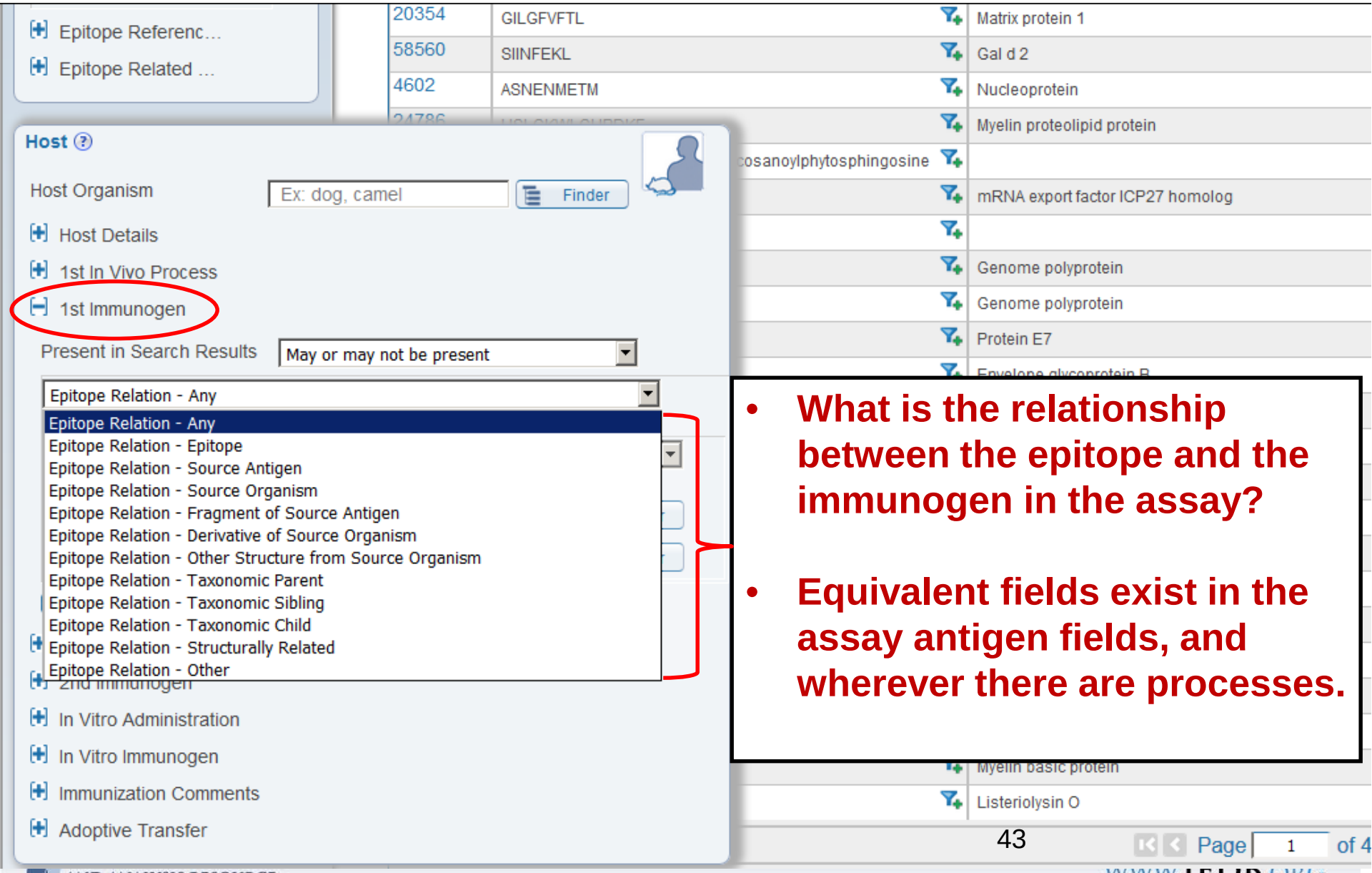
109298 Records Found

Describes how the host acquired immune reactivity.

Assay Details – In Vivo Process Types



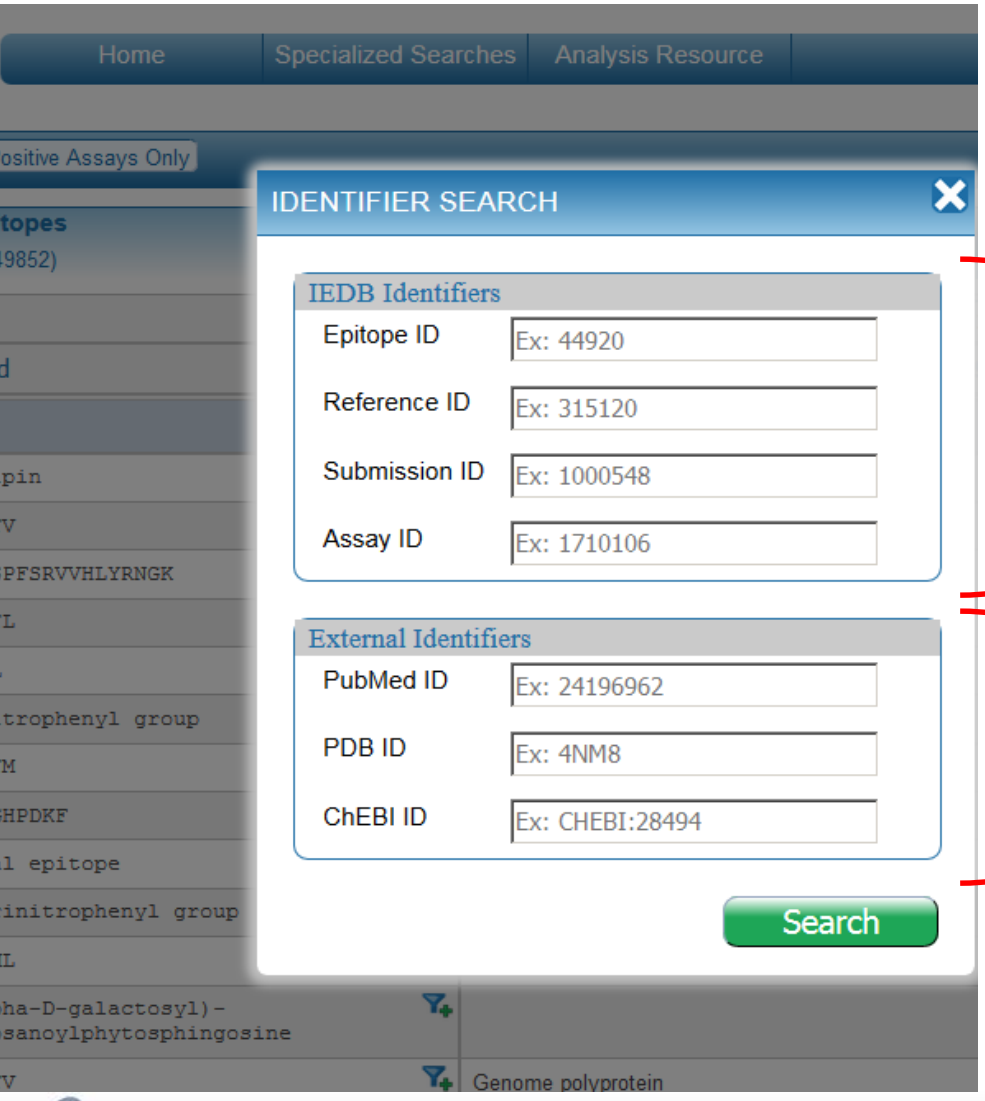
Assay Details – Immunogen-Epitope Relation



- **What is the relationship between the epitope and the immunogen in the assay?**
- **Equivalent fields exist in the assay antigen fields, and wherever there are processes.**

Identifier Search

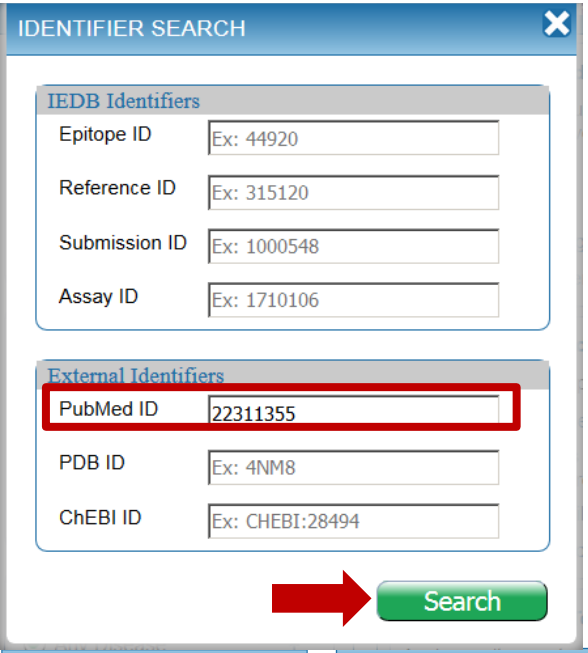
A quick way to retrieve data by using an “inventory number”

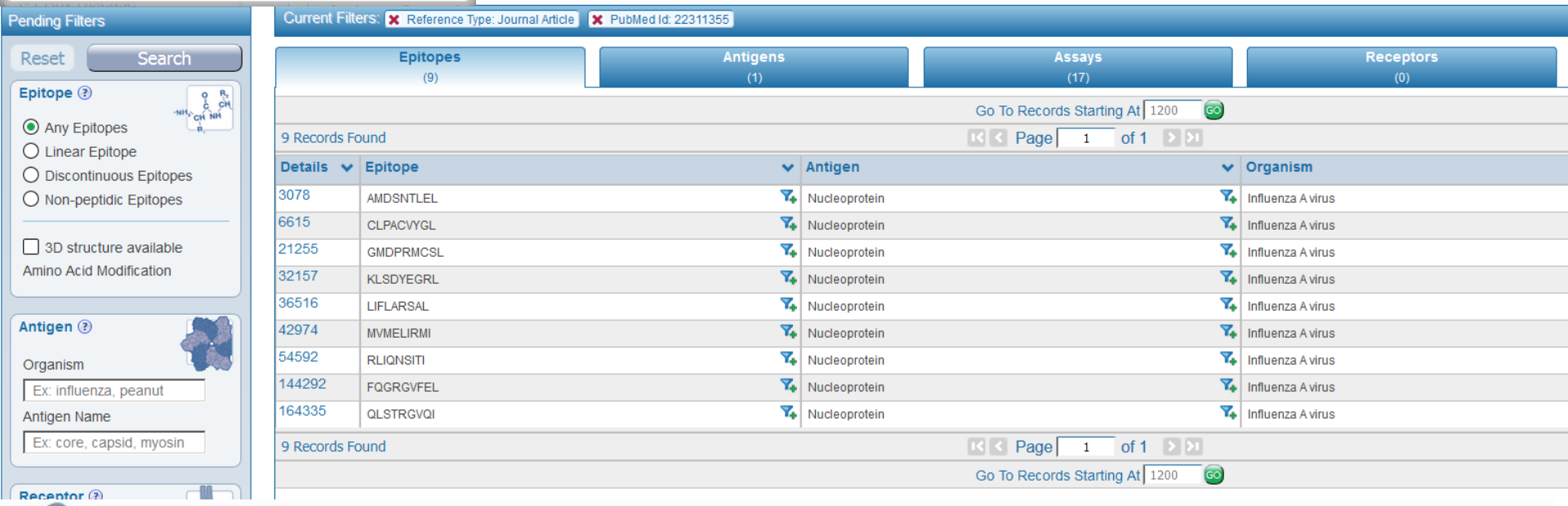


Unique identifiers created by IEDB

Unique identifiers from other resources

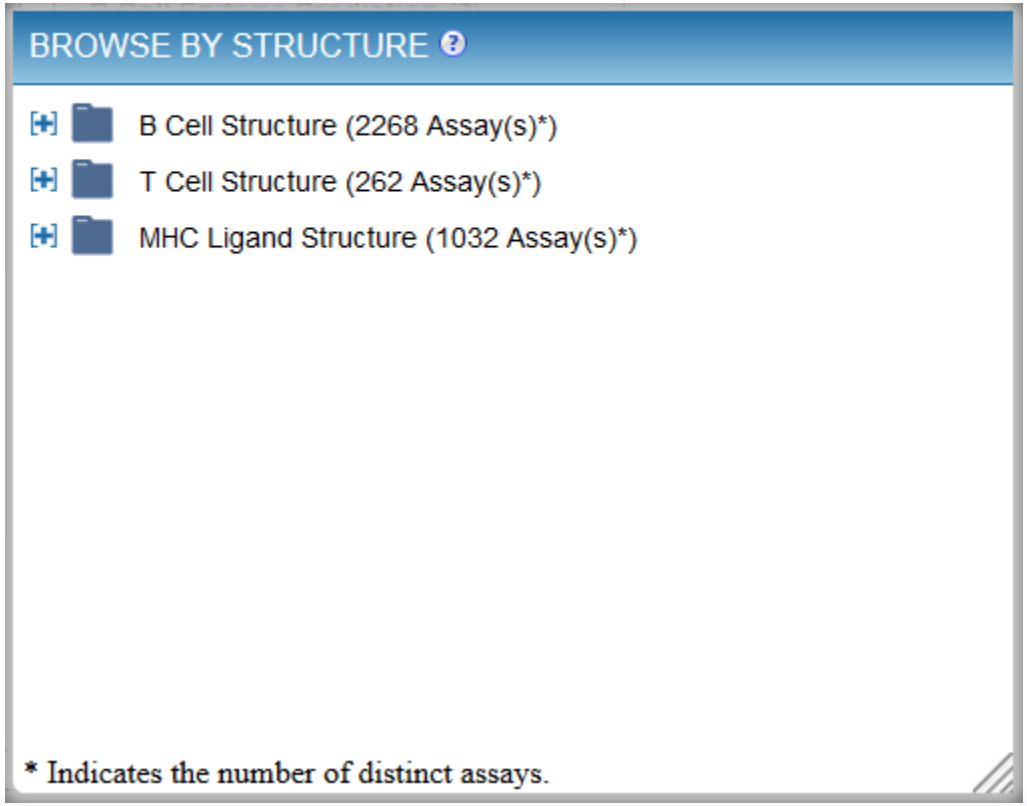
Identifier Search



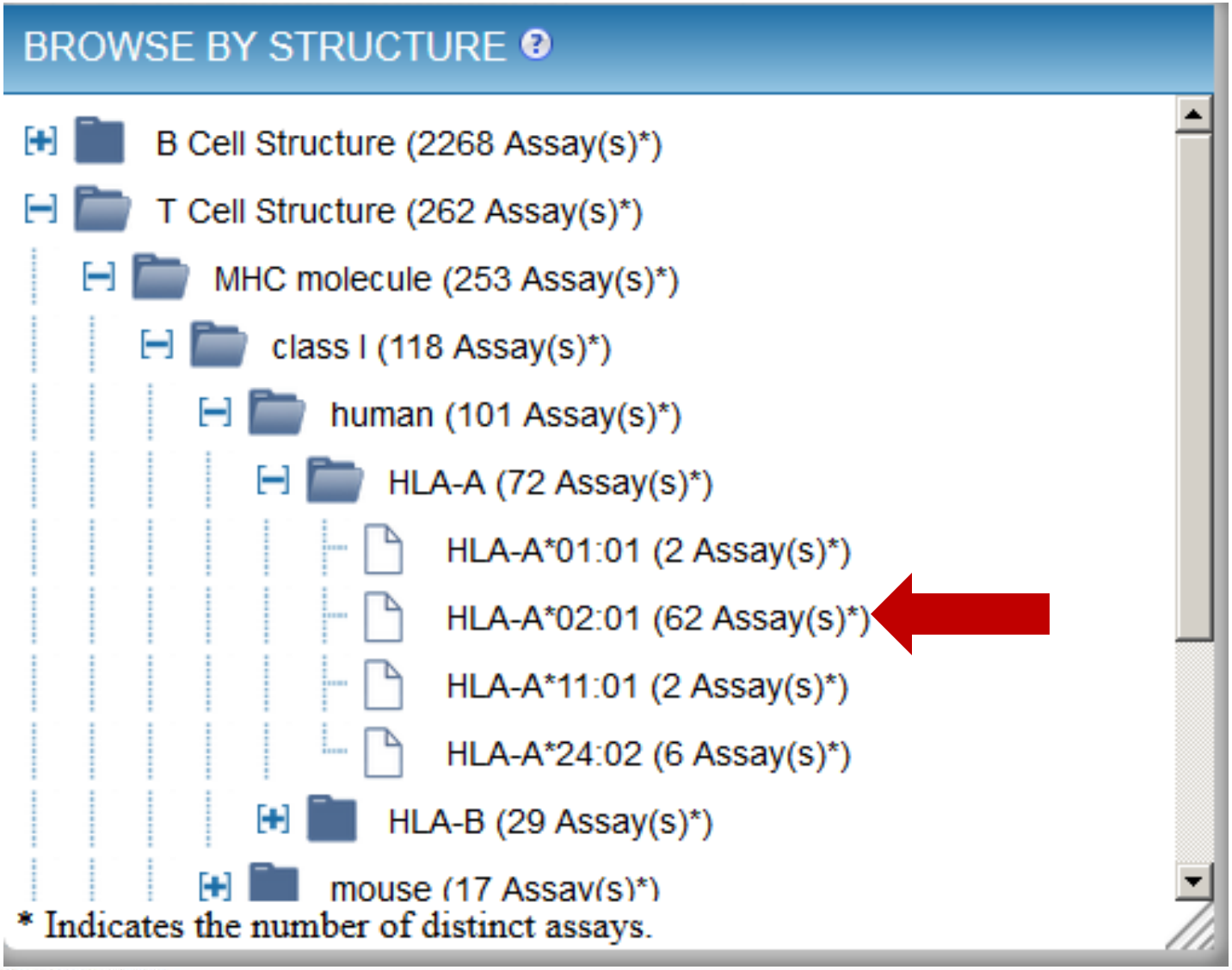


Browse by 3D Structure

Branches of tree organized by organism that is source of antibody, T Cell, and MHC molecule, respectively.



Browse by 3D Structure



Browse by 3D Structure

Current Filters: Positive Assays Only | No B cell assays | No MHC ligand assays | MHC Restriction Type: HLA-A*02:01 | 3D structure available

Epitopes (35) | Antigens (15) | Assays (62) | Receptors (32)

T Cell Assays (62) | B Cell Assays (0) | MHC Ligand Assays (0)

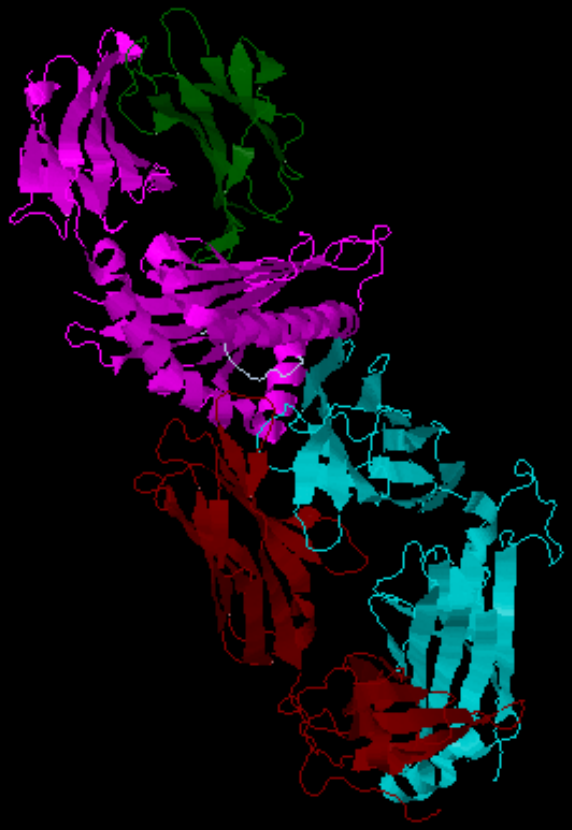
Go To Records Starting At A,b GO

62 Records Found

Page 1 of 3

ID	Reference	Epitope	Host	Immunization	Assay Antigen	Antigen Epitope Relation	MHC Rest
2119223	[illegible]vych; J Immunol 2011	AAGIGILTV Melanoma antigen recognized by T-cells 1 (27-35) Homo sapiens	Homo sapiens	Occurrence of cancer (skin melanoma)	AAGIGILTV Melanoma antigen recognized by T-cells 1 (27-35) Homo sapiens	Epitope	HLA-...
1617229	Jennifer Buslepp; Immunity 2003	ALWGFFPVL chromosome 15 open reading frame 24 (4-12) Homo sapiens	Mus musculus HLA-A*0201 Tg	Administration in vivo with chromosome 15 open reading frame 24 (Source Antigen) followed by restimulation in vitro	ALWGFFPVL chromosome 15 open reading frame 24 (4-12) Homo sapiens	Epitope	HLA-...
1883845	David K Cole; J Biol Chem 2009	ELAGIGILTV	Homo sapiens	Primary induction in vitro with ELAGIGILTV (Epitope)	ELAGIGILTV	Epitope	HLA-...
1981555	Florian Madura; J Biol Chem 2013	ELAGIGILTV	Homo sapiens	Primary induction in vitro with ELAGIGILTV (Epitope)	ELAGIGILTV	Epitope	HLA-...
2118926	Brian G Pierce; PLoS Comput Biol 2014	ELAGIGILTV	Homo sapiens	Occurrence of cancer (skin melanoma)	ELAGIGILTV	Epitope	HLA-...
2119220	Oleg Y Borbulevych; J Immunol 2011	ELAGIGILTV	Homo sapiens	Occurrence of cancer (skin melanoma)	ELAGIGILTV	Epitope	HLA-...
3134129	InYoung Song; Nat Struct Mol Biol 2017	GILGFVFTL Matrix protein 1 (58-66) Influenza A virus	Homo sapiens	Exposure to endemic/ubiqitious agent Influenza A virus (Source Organism) without evidence for disease followed by restimulation in vitro	GILGFVFTL Matrix protein 1 (58-66) Influenza A virus	Epitope	HLA-...
3134130	InYoung Song;	GILGFVFTL	Homo sapiens	Exposure to	GILGFVFTL	Epitope	HLA-...

3D Viewer



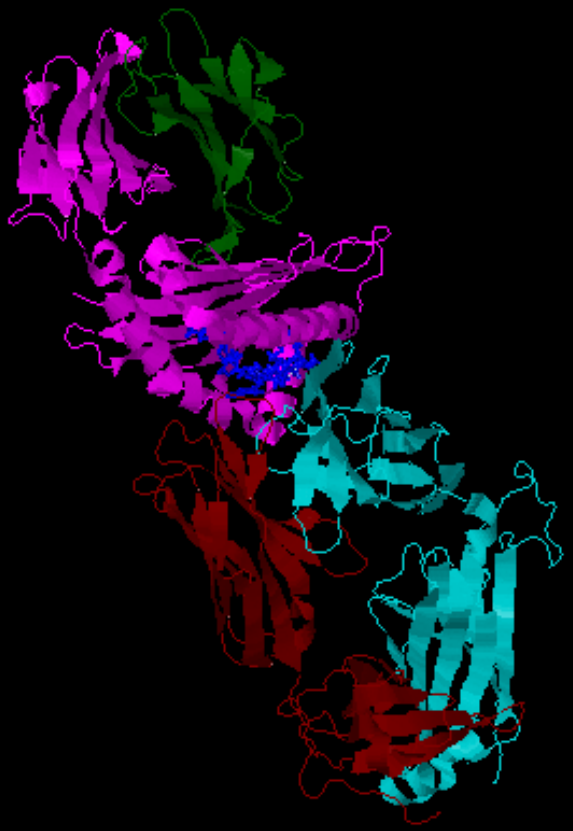
JSmol

- Epitope to MHC
  - G1
  - I2
  - L3
  - G4
  - F5
  - V6
  - F7
  - T8
  - L9
- Epitope to TCR
- MHC to Epitope
- TCR to Epitope

Chains: MHC-alpha MHC-b2m TCR-Chain 1 TCR-Chain 2 Epitope Chain

Calculated contacts: Epitope to MHC Epitope to TCR MHC to Epitope TCR to Epitope

3D Viewer



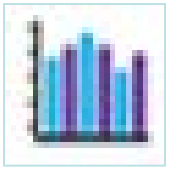
- Epitope to MHC
  - G1
  - I2
  - L3
  - G4
  - F5
  - V6
  - F7
  - T8
  - L9
- Epitope to TCR
- MHC to Epitope
- TCR to Epitope

Chains: MHC-alpha MHC-b2m TCR-Chain 1 TCR-Chain 2 Epitope Chain

Calculated contacts: Epitope to MHC Epitope to TCR MHC to Epitope TCR to Epitope

Break

10:30-10:45am



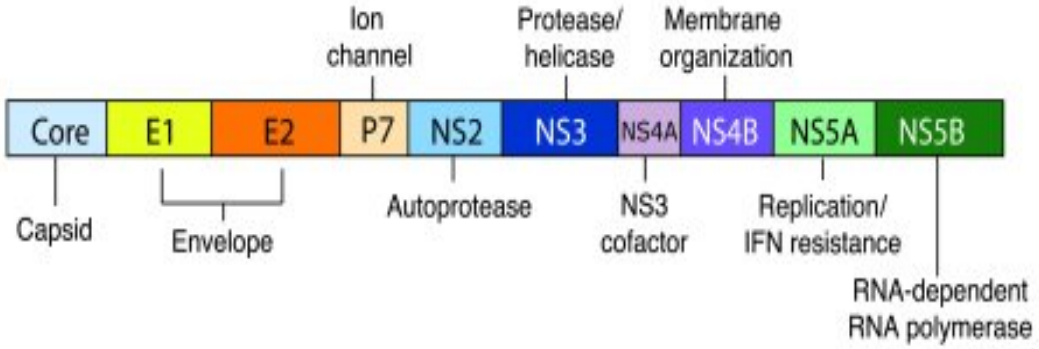
Immunome Browser (IB)

The IB is a unique analysis tool that is integrated into query interface

- **What is it?**
  Maps the immunome – visualize the totality of immune reactivities
  - individual proteins and polyproteins
- **What is it for?**
  What are potentially 'immunodominant' epitopes?
  What regions on an antigen are well-characterized?
- **Where is it located?**
  IB icon found on the Antigen Tab of Results page
- **How does it work?**
  For a given query, the IB plots the response frequency scores (RFscores) for epitopes along the length of antigen using a reference proteome (per residue).

➡ Designed to **visualize** the entirety or an optimized subset of data

Immunome Browser Example



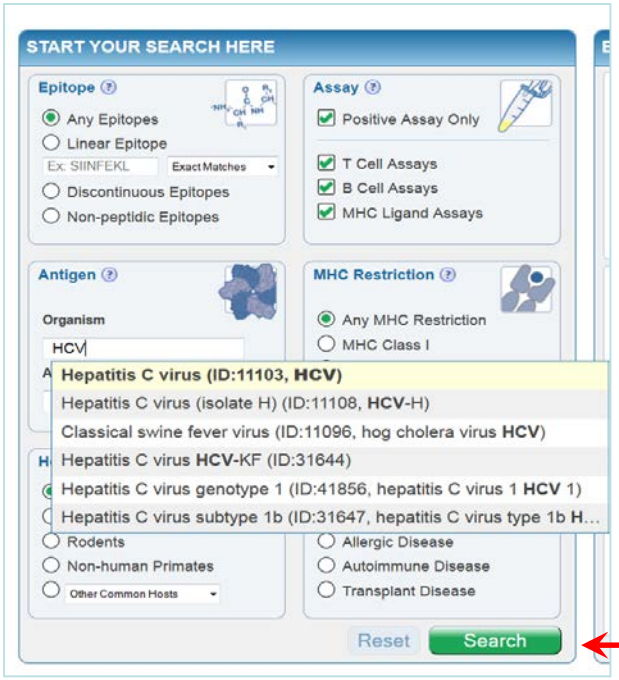
Hepatitis C virus (HCV)

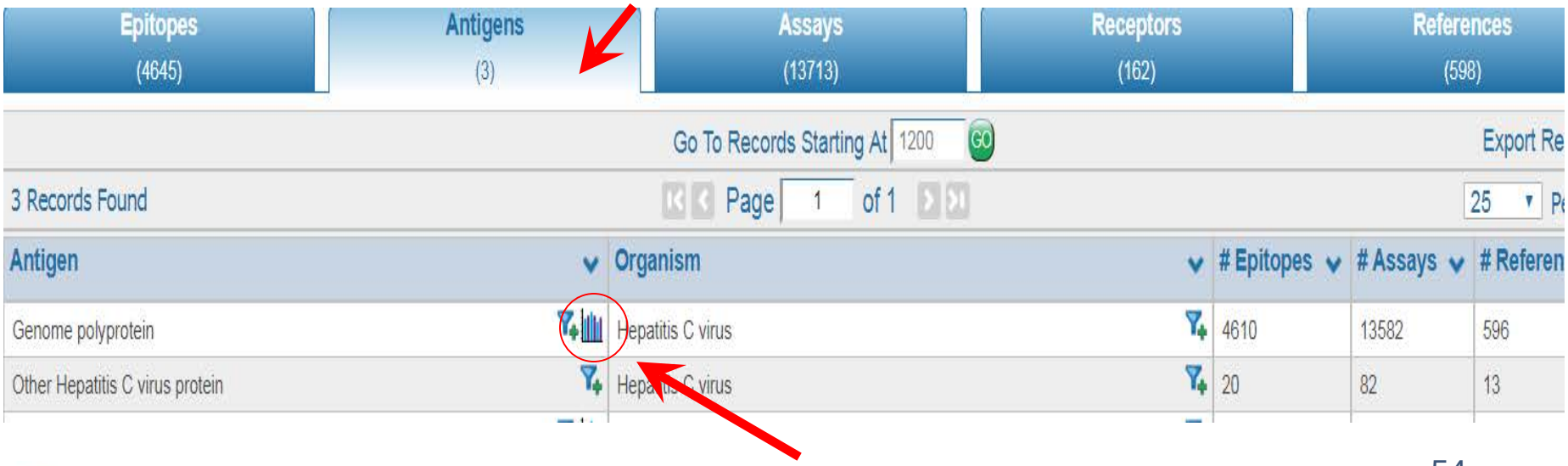
- Genomic polyprotein ~3,000 aa
- >4,000 epitopes captured in the IEDB
- Abundance reflects iterative coverage
  - multiple labs, assays, hosts
- Can view overall coverage
- Can identify ‘choice trees’ within the ‘forest’
- Selection criteria can be broad or very stringent

Immunome Browser – How it works

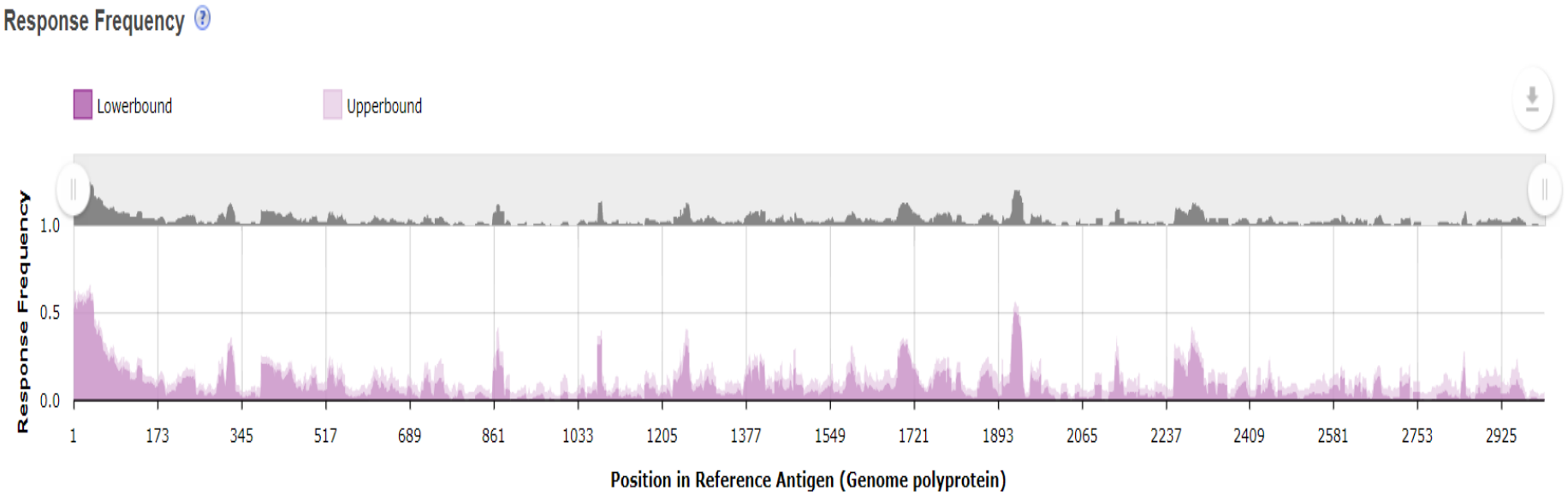
A '**HCV**' search from the Home page

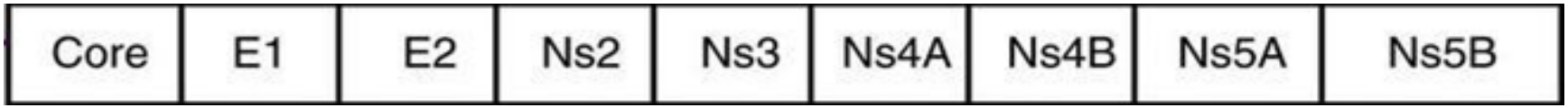
- 4,645 epitopes
- >13,700 assays from 598 papers
- Click Immunome Browser icon  to map





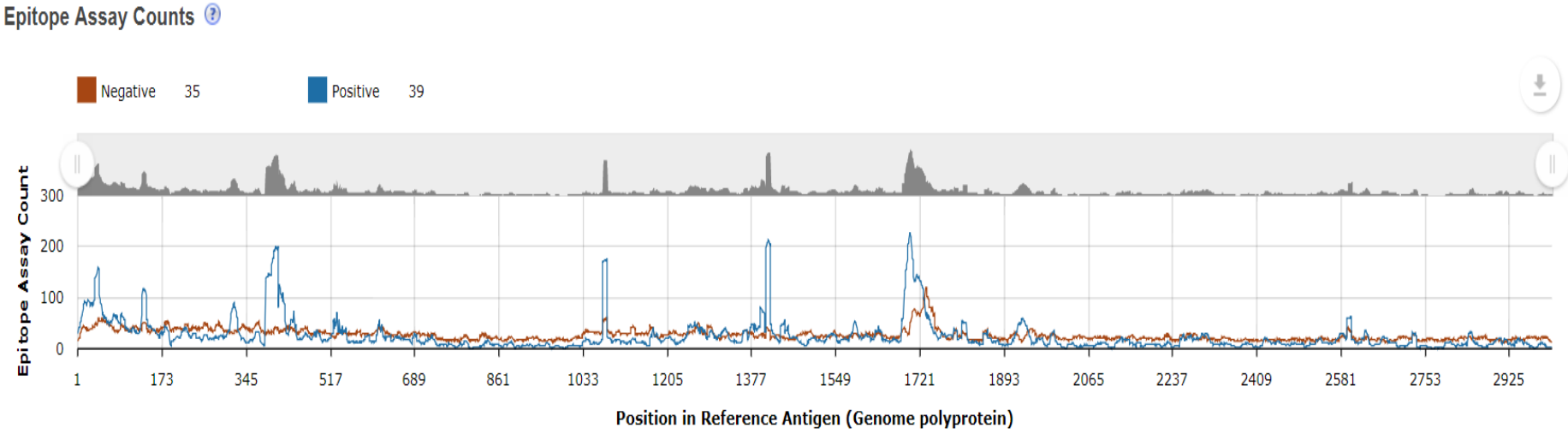
Response Frequency Graph





Top graph:
Y-axis = RFscore
X-axis = epitope residue position

Assay Counts Graph



Core	E1	E2	Ns2	Ns3	Ns4A	Ns4B	Ns5A	Ns5B

Bottom graph:
Positive and Negative assay count

IB Data Table

Results Returned: 7349 | Displaying: 7349 ☐ Display Graphed Residue Positions Export Results

Epitope ID	Epitope Sequence	Mapped Position	Identity	Subjects Tested	Subjects Responded	Assays Positive	Assays Negative	Response Freq. (95% CI)
42674	MSTIPLPZRLTKRNTNRRPZ	1-20	75%	10	6	1	0	0.60 (0.30:0.84)
42704	MSTNPKPQRKTKRNTNRRPQDVKFPGGGQIVGGVYLLPRRGPRL	1-44	100%	1	1	1	0	1.00 (0.04:1.00)
42688	MSTNPKPQKKNKRNTNRRPQDVKFPGGGQI	1-30	93%	5	4	1	0	0.80 (0.34:0.99)
42691	MSTNPKPQR	1-9	100%	3	0	0	1	0.00 (0.00:0.61)
42701	MSTNPKPQRKTKRNTNRRPQDVKFPG	1-26	100%	10	10	1	0	1.00 (0.74:1.00)
42693	MSTNPKPQRKIKRNTNRRPQDVKFPGGG	1-28	96%	1	1	1	0	1.00 (0.04:1.00)
42703	MSTNPKPQRKTKRNTNRRPQDVKFPGGGQI	1-30	100%	5	4	1	0	0.80 (0.34:0.99)
42685	MSTNPKPQKKNKRNTNRRPQ	1-20	90%	23	1	1	1	0.04 (0.00:0.18)
42702	MSTNPKPQRKTKRNTNRRPQDVKFPGGG	1-28	100%	60	52	1	0	0.87 (0.76:0.93)
42705	MSTNPKPQRKTKRNTSRRPQDVKFPGGGQI	1-30	96%	30	4	1	0	0.13 (0.05:0.27)
42684	MSTNPKPQKKNKRNTNRR	1-18	88%	14	14	1	0	1.00 (0.81:1.00)
42673	MSTIPKPQRKTKRN	1-14	92%	60	3	1	0	0.05 (0.02:0.14)
42700	MSTNPKPQRKTKRNTNRRPQDV	1-22	100%	1	1	1	0	1.00 (0.04:1.00)
150453	MSTLPKPQRKTKRNTIRRPQ	1-20	90%	1	0	0	1	0.00 (0.00:0.94)
462400	MSTNPKPQRKTKRNTNRRPQDVKFPGGGQIVGGVY	1-35	100%	2	2	1	0	1.00 (0.22:1.00)
42681	MSTNPKPQIKTKRNTNRR	1-19	94%	1	0	0	1	0.00 (0.00:0.94)

Sequence

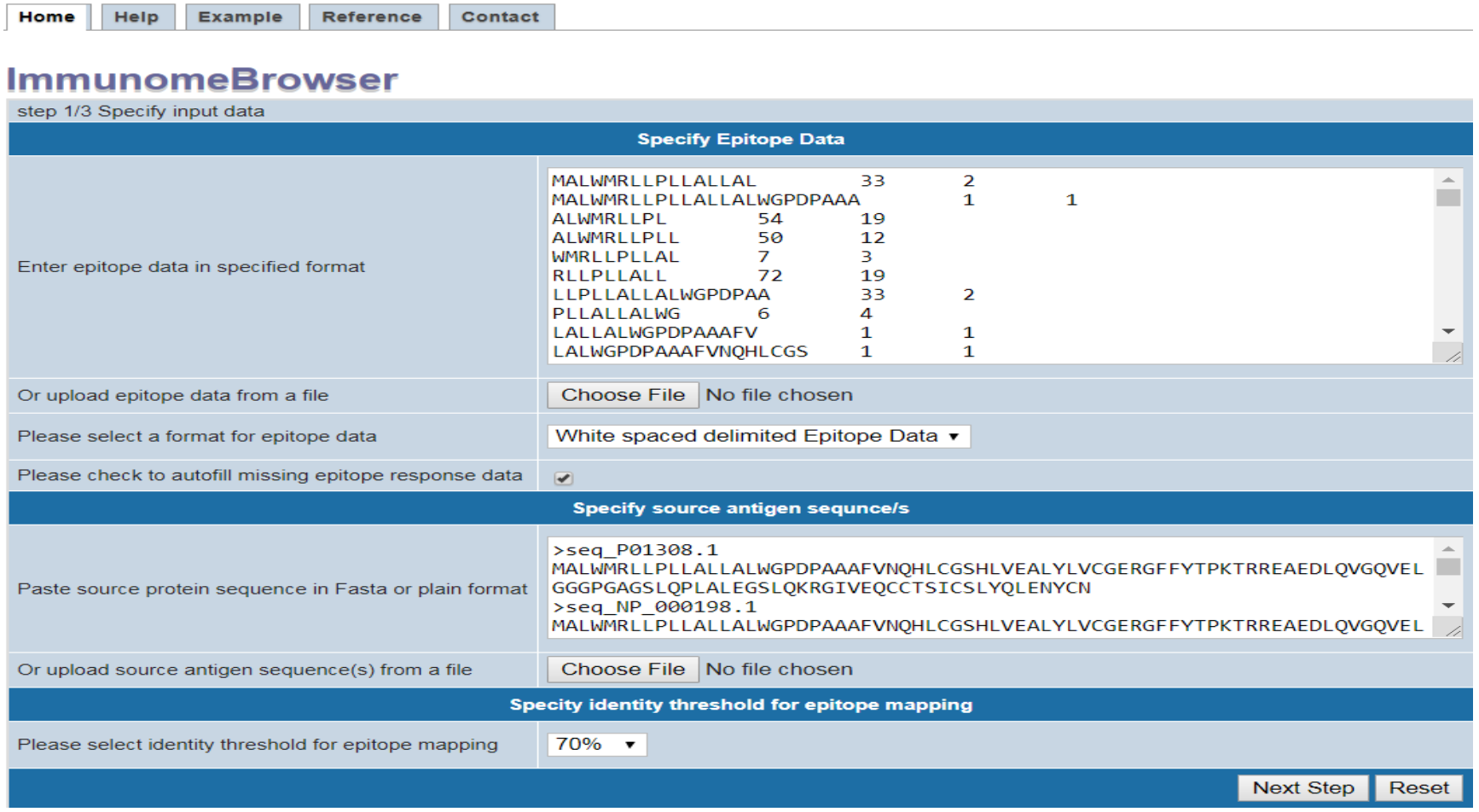
Position

+/- assay counts

RFscore

IB - stand alone version

A tool to aggregate and visualize user supplied epitopes and antigen [PMID: 29878047]



Located under 'Epitope Analysis Tools' or at 'tools.iedb.org/immunomebrowser'

Cancer

Programmatically, cancer is not currently within the scope of the IEDB.

IEDB does contain data as part of in-scope papers: cancer from pathogens and ligand elution MS data

How would I find cancer epitopes?

On Main Page

- Search **by antigen** – e.g. Pmel
- Search **by disease** – ovarian cancer, breast cancer, melanoma, etc.

In Specialize Searches – Epitope Details

Under 'Epitope Related Object'

- '**Neo-epitope of**'

Queries with *vaccine development* in mind

- Select for **human** data

- **Natural infection**
  - Occurr of infect disease, immunogen = organism
- **Vaccination**
  - *in vivo* administration, immunogen = protein or organism

Specialized Search - Process type

- ***In vitro assays that define* 'correlates of protection'**
  - Neutralization, CTL, IFNg, etc.

- ***In vivo* challenge assays demonstrating protection**
  - Survival, decreased pathogen burden
  - Treatment Assays (prophylactic/therapeutic)

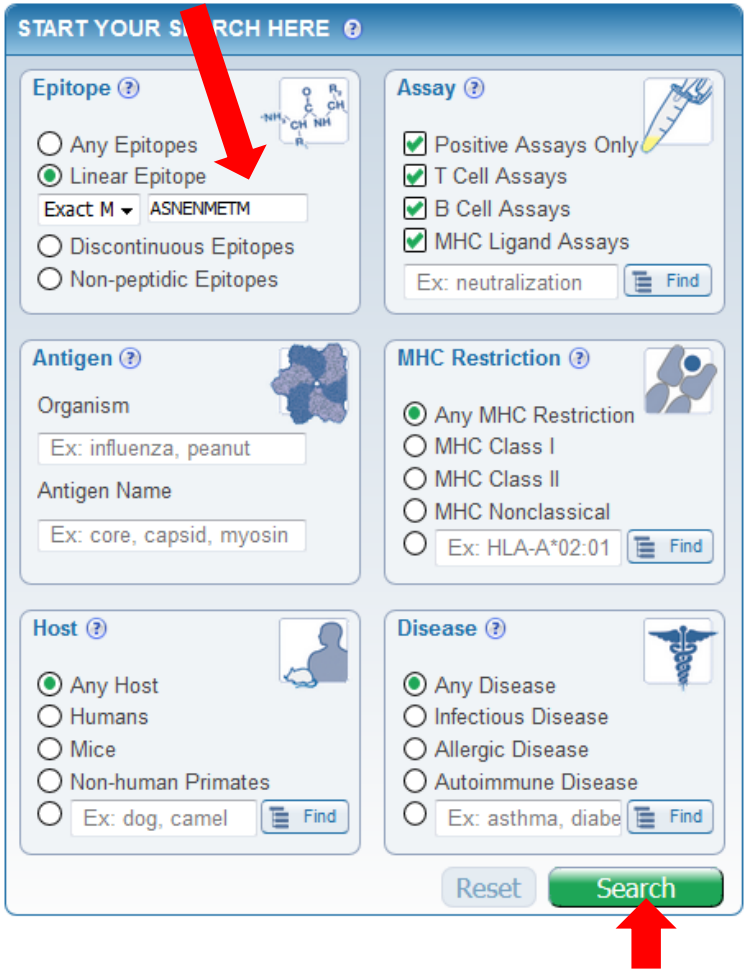
Assay specific Query

- **'Coverage' and/or Immunoprominence**
  - Immunome Browser

Results Page Antigen Tab

Example Queries

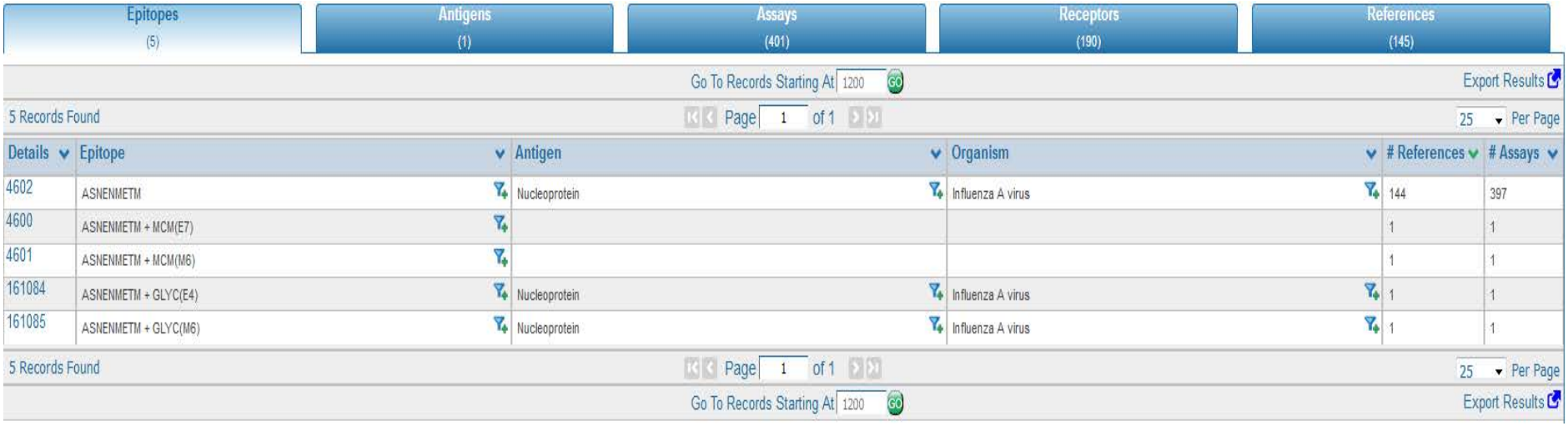
Example query for the epitope sequence ASNENMETM (NP Flu A)



Elements highlighted

- Sequence search
- Homology search
- Filter and drill down
- Results table
  - Summary
  - Data details

Results Page - summarized on tabs



Epitopes (5) | Antigens (1) | Assays (401) | Receptors (190) | References (145)

Go To Records Starting At 1200 GO — Export Results

5 Records Found — Page 1 of 1 — 25 Per Page

Details	Epitope	Antigen	Organism	# References	# Assays
4602	ASNENMETM	Nucleoprotein	Influenza A virus	144	397
4600	ASNENMETM + MCM(E7)			1	1
4601	ASNENMETM + MCM(M6)			1	1
161084	ASNENMETM + GLYC(E4)	Nucleoprotein	Influenza A virus	1	1
161085	ASNENMETM + GLYC(M6)	Nucleoprotein	Influenza A virus	1	1

5 Records Found — Page 1 of 1 — 25 Per Page

Go To Records Starting At 1200 GO — Export Results

- 5 structures, includes structures with modifications
- Source antigen = Nucleoprotein
- 401 assays
- 190 receptors (TCR)
- 145 references

  Can then click through the tabs to review data

Assay Tab

itopes (5) | Antigens (1) | Assays (401) | Receptors (190) | References (145)

T Cell Assays (351) | B Cell Assays (0) | MHC Ligand Assays (50)

Go To Records Starting At A,b GO

351 Records Found

Page 1 of 15

ID	Reference	Epitope	Host	Immunization	Assay Antigen	Antigen Epitope Relation	MHC Restriction	Assay Description
1657688	A R Alsheikhly Scand J Immunol 1994	ASNENMETM nucleoprotein (366-374) Influenza A virus	Mus musculus C57BL/6	Primary induction in vitro with ASNENMETM (Epitope)	NLDNLRDYL large T antigen (493-501) Macaca mulatta polyomavirus 1	Other	H2-b class I	51 chromium cytotoxicity **Positive-Low**
19[illegible]19	J A Speir; Immunity 1999	ASNENMETM + GLYC(E4) Nucleoprotein (366-374) Influenza A virus (A/Puerto Rico/8/1934(H1N1))	Mus musculus C57BL/6	Administration in vivo with ASNENMETM + GLYC(E4) (Epitope) followed by restimulation in vitro	ASNENMETM + GLYC(E4) Nucleoprotein (366-374) Influenza A virus (A/Puerto Rico/8 /1934(H1N1))	Epitope	H2-Db	51 chromium cytotoxicity **Positive-Low**
1865256	G T Belz; J Virol 2000	ASNENMETM Nucleoprotein (366-374) Influenza A virus (A/Puerto Rico/8/1934(H1N1))	Mus musculus C57BL/6	Administration in vivo with Influenza A virus (A/X-31(H3N2)) A/X-31 X HK (Taxonomic Sibling) followed by restimulation in vitro	ASNENMETM Nucleoprotein (366-374) Influenza A virus (A/Puerto Rico/8 /1934(H1N1))	Epitope	H2-Db	51 chromium cytotoxicity **Positive-Low**
1903617	J A Speir; Immunity 1999	ASNENMETM + GLYC(M6) Nucleoprotein (366-374) Influenza A virus (A/Puerto Rico/8/1934(H1N1))	Mus musculus C57BL/6	Administration in vivo with ASNENMETM + GLYC(M6) (Epitope) followed by restimulation in vitro	ASNENMETM + GLYC(M6) Nucleoprotein (366-374) Influenza A virus (A/Puerto Rico/8 /1934(H1N1))	Epitope	H2-Db	51 chromium cytotoxicity **Positive-Low**
1004021	R A Uger; J Immunol 1999	ASNENMETM Nucleoprotein (366-374) Influenza A virus	Mus musculus C57BL/6	Administration in vivo with Influenza A virus (Source Organism) followed by restimulation in vitro	ASNENMETM Nucleoprotein (366-374) Influenza A virus	Epitope	H2-Db	51 chromium cytotoxicity **Positive**
1479085	Nicole L La Gruta; Proc Natl Acad Sci U S A 2008	ASNENMETM Nucleoprotein (366-374) Influenza A virus	Mus musculus C57BL/6	Administration in vivo with Influenza A virus (A/X-31(H3N2)) (Taxonomic Child)	ASNENMETM Nucleoprotein (366-374) Influenza A virus	Epitope	H2-Db	51 chromium cytotoxicity **Positive**
1266964	M B Oldstone; Virology 1999	ASNENMETM nucleoprotein (366-374) Influenza A virus	Mus musculus	Administration in vivo with Influenza A virus (Source Organism) followed by restimulation in vitro	ASNENMETM nucleoprotein (366-374) Influenza A virus	Epitope	H2-Db	51 chromium cytotoxicity **Positive**

- 351 T cell assays
- 50 MHC Ligand assays
- Use columns to review high level
- Click on assay ID to see all details

References tab

Epitopes (5) | Antigens (1) | Assays (401) | Receptors (190) | References (145)

Go To Records Starting At 1982 GO

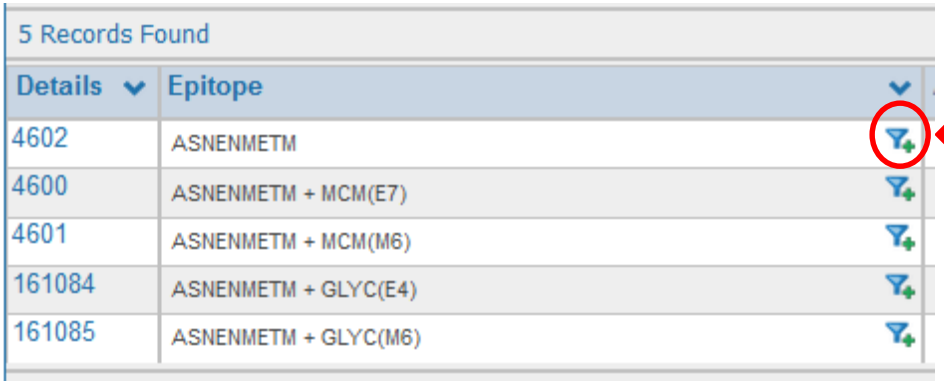
145 Records Found

Page 1 of 6

Ref ID	PMID	Author	Title	Abstract	Date
1032692	28872670	Akihiro Yoshizawa; Kevin Bi; Derin B Keskin; Guanglan Zhang; Bruce Reinhold; Ellis L Reinherz	TCR-pMHC encounter differentially regulates transcriptomes of tissue-resident CD8 T cells.	To investigate the role of TCR-pMHC interaction in regulating lung CD8 tissue-resident T cell (TR) differentiation, polyclonal responses were compared against NP366-374 /Db and PA224-233 /Db , two im ...more...	2018
1[illegible]29	28974367	M Fehlings; S Chakarov; Y Simoni; B Sivasankar; F Ginhoux; E W Newell	Multiplex peptide-MHC tetramer staining using mass cytometry for deep analysis of the influenza-specific T-cell response in mice.	Antigen-specific T cells play a crucial role for the host protective immunity against viruses and other diseases. The use of mass cytometry together with a combinatorial multiplex tetramer staining ha ...more...	2018
1033108	29274250	Simona Anticoli; Francesco Manfredi; Chiara Chiozzini; Claudia Arenaccio; Eleonora Olivetta; Flavia Ferrantelli; Antonio Capocefalo; Emiliana Falcone; Anna Ruggieri; Maurizio Federico	An Exosome-Based Vaccine Platform Imparts Cytotoxic T Lymphocyte Immunity Against Viral Antigens.	Exosomes are 50-150 nm sized nanovesicles released by all eukaryotic cells. The authors very recently described a method to engineer exosomes in vivo with the E7 protein of Human Papilloma Virus (HPV) ...more...	2018
1031880	28636592	Pradyot Dash; Andrew J Fiore-Gartland; Tomer Hertz; George C Wang; Shalini Sharma; Aisha Souquette; Jeremy Chase Crawford; E Bridie Clemens; Thi H O Nguyen; Katherine Kedzierska; Nicole L La Gruta; Philip Bradley; Paul G Thomas	Quantifiable predictive features define epitope-specific T cell receptor repertoires.	T cells are defined by a heterodimeric surface receptor, the T cell receptor (TCR), that mediates recognition of pathogen-associated epitopes through interactions with peptide and major histocompatibi ...more...	2017
1031759	28615708	Lana Vandersarren; Cedric Bosteels; Manon Vanheerswynghels; James J Moon; Andrew J Easton; Gert Van Isterdael; Sophie Janssens; Bart N Lambrecht; Mary J van Helden	Epitope mapping and kinetics of CD4 T cell immunity to pneumonia virus of mice in the C57BL/6 strain.	Pneumonia virus of mice (PVM) infection has been widely used as a rodent model to study the closely related human respiratory syncytial virus (hRSV). While T cells are indispensable for viral clearanc ...more...	2017
1032055	26873987	Alison J Carey; Donald T Gracias; Jillian L Thayer; Alina C Boesteanu; Ogan K Kumova; Yvonne M Mueller; Jennifer L Hope; Joseph A Fraietta; David B H van Zessen; Peter D Katsikis	Rapid Evolution of the CD8+ TCR Repertoire in Neonatal Mice.	Currently, there is little consensus regarding the most appropriate animal model to study acute infection and the virus-specific CD8(+) T cell (CTL) responses in neonates. TCR high-throughput sequenci ...more...	2016

- Listed by most recent pub year
- Link to PubMed (blue PMID)
- Use columns to review high level
- Click on Ref ID to summary table

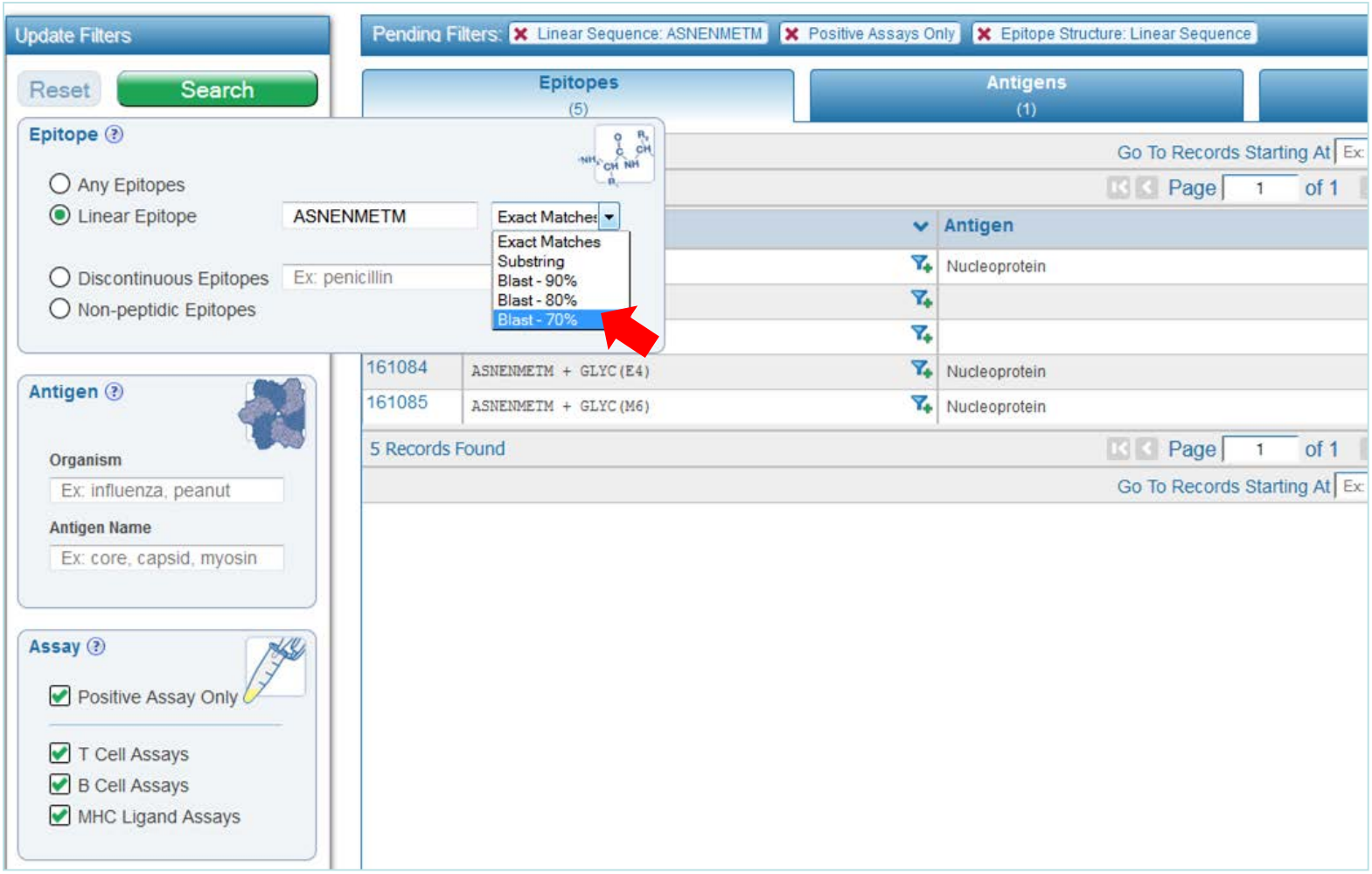
Filtering feature



Click on 'funnel' to select an epitope of interest

Tabs will re-set data for only that epitope

Looking for homologous peptides



Refined query at 70% homology reveals variants as well as analogs the flu epitope

Epitopes (176) | Antigens (2) | Assays (780)

Go To Records Starting At 1200 GO

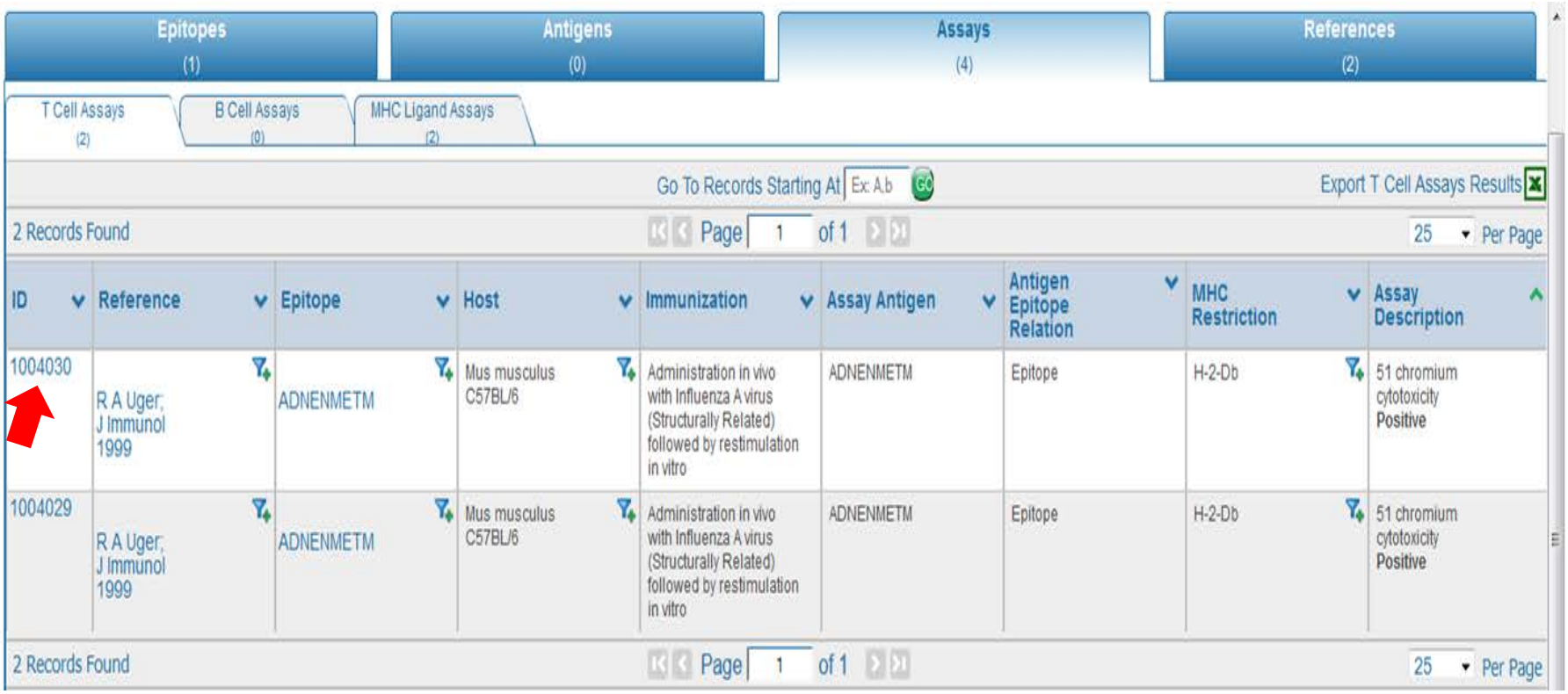
176 Records Found Page 1 of 8

Details	Epitope	Antigen	Organism
4602	ASNENMETM	Nucleoprotein	Influenza A virus
4578	ASNENMDAM	Nucleoprotein	Influenza A virus
4630	ASNENVETM	Nucleoprotein	Influenza A virus
25439	IASNENMETMESSTLE	Nucleoprotein	Influenza A virus
4629	ASNENTETM	Nucleoprotein	Influenza A virus
4580	ASNENMDTM	Nucleoprotein	Influenza A virus
4581	ASNENMEAM	Nucleoprotein	Influenza A virus
25434	IASNENMDAMESSTL	Nucleoprotein	Influenza A virus
4564	ASNENAETM	Nucleoprotein	Influenza A virus
4573	ASNENIETM	Nucleoprotein	Influenza A virus
4605	ASNENMEVM	Nucleoprotein	Influenza A virus
25435	IASNENMDAMESSTLE	Nucleoprotein	Influenza A virus
318	AANENMETM		
733	ADNENMETM		
1092	AENENMETM		
1619	AGNENMETM		
	ETM		
	TM		
	ETM		
	ETM		
3356	ANNENMETM		
3662	APNENMETM	Nucleoprotein	Influenza A virus
4012	AQNENMETM		
4200	ARNENMETM		
4304	ASAENMETM		

Identify analog of interest

Filter on this epitope

4 assays reported for this analog – 2 T cell and 2 MHC ligand
Explore T cell first….



Epitopes (1) | Antigens (0) | Assays (4) | References (2)

T Cell Assays (2) | B Cell Assays (0) | MHC Ligand Assays (2)

Go To Records Starting At Ex: A,b GO Export T Cell Assays Results

2 Records Found Page 1 of 1 25 Per Page

ID	Reference	Epitope	Host	Immunization	Assay Antigen	Antigen Epitope Relation	MHC Restriction	Assay Description
1004030	R A Uger; J Immunol 1999	ADNENMETM	Mus musculus C57BL/6	Administration in vivo with Influenza A virus (Structurally Related) followed by restimulation in vitro	ADNENMETM	Epitope	H-2-Db	51 chromium cytotoxicity Positive
1004029	R A Uger; J Immunol 1999	ADNENMETM	Mus musculus C57BL/6	Administration in vivo with Influenza A virus (Structurally Related) followed by restimulation in vitro	ADNENMETM	Epitope	H-2-Db	51 chromium cytotoxicity Positive

2 Records Found Page 1 of 1 25 Per Page

- Click on the **assay ID** to drill down into details of assay
- Click other assay tabs (MHC Ligand Assays) to review all relevant assays

Full details for this assay:

- Reference
- Epitope
- Host
- Immunization
- Assay type
- Antigen

Reference Information

Reference	
Article Authors:	R A Uger; S M Chan; B H Barber
Article Title:	Covalent linkage to beta2-microglobulin enhances the MHC stability and antigenicity of suboptimal CTL epitopes.
Reference Detail	
Reference ID:	1000159
Abstract:	Many CTL epitopes of clinical importance, particularly those derived from tumor Ags, display relatively poor MHC binding affinity and stability. Because in vivo immunogenicity, and thus the efficacy of peptide-based vaccines, is thought to be determined by MHC/peptide complex stability, there is a need to develop a simple strategy for enhancing the binding of suboptimal epitopes. Toward this goal, the ability to enhance suboptimal peptides through covalent linkage to beta2-microglobulin (beta2m) was explored. Two suboptimal variants of a high-affinity Db-restricted influenza nucleoprotein peptide were covalently linked, via a polypeptide spacer, to the amino terminus of human beta2m and the recombinant fusion proteins expressed in Escherichia coli. When compared with their uncoupled counterparts, the beta2m-linked epitopes display enhanced MHC stabilization and antigenicity. Thus, tethering epitopes to beta2m provides a simple method for augmenting the biological activity of suboptimal peptides and could be useful in the design of peptide-based vaccines or immunotherapeutics.
Affiliations:	Department of Immunology, Medical Sciences Building, University of Toronto, Toronto, Canada.
Date:	1999
Reference Type:	Literature
PubMed ID:	10229842
Journal:	J Immunol
Journal Volume:	162
Article Pages:	6024-8
Journal ISSN:	0022-1767
Article Chemical List:	Antigens, Viral;Epitopes;Nucleoproteins;Recombinant Fusion Proteins;Vaccines, Synthetic;Viral Core Proteins;beta 2-Microglobulin
Article MeSH List:	Animals; Antigens, Viral(immunology); Cytotoxicity, Immunologic; Drug Design; Epitopes(genetics; immunology); Humans; Major Histocompatibility Complex(immunology); Mice; Mice, Inbred BALB C; Mice, Inbred C57BL; Nucleoproteins(genetics; immunology); Orthomyxoviridae(genetics; immunology); Protein Binding; Recombinant Fusion Proteins(immunology); T-Lymphocytes, Cytotoxic(immunology); Vaccines, Synthetic; Viral Core Proteins(genetics; immunology); beta 2-Microglobulin(genetics; immunology)

Epitope Information

Epitope	
Epitope ID:	733
Chemical Type:	Linear peptide
Linear Sequence:	ADNENMETM
Epitope Reference Details	
Epitope Structure Defines:	Exact Epitope
Epitope Name:	D2
Epitope Related Object	
Related Object Type:	The epitope is an analog of:
Chemical Type:	Linear peptide
Linear Sequence:	ASNENMETM
Starting Position:	366
Ending Position:	374
Source Molecule Name:	Nucleoprotein
Source Accession:	SRC124
Source Organism ID:	11320
Source Organism:	Influenza A virus

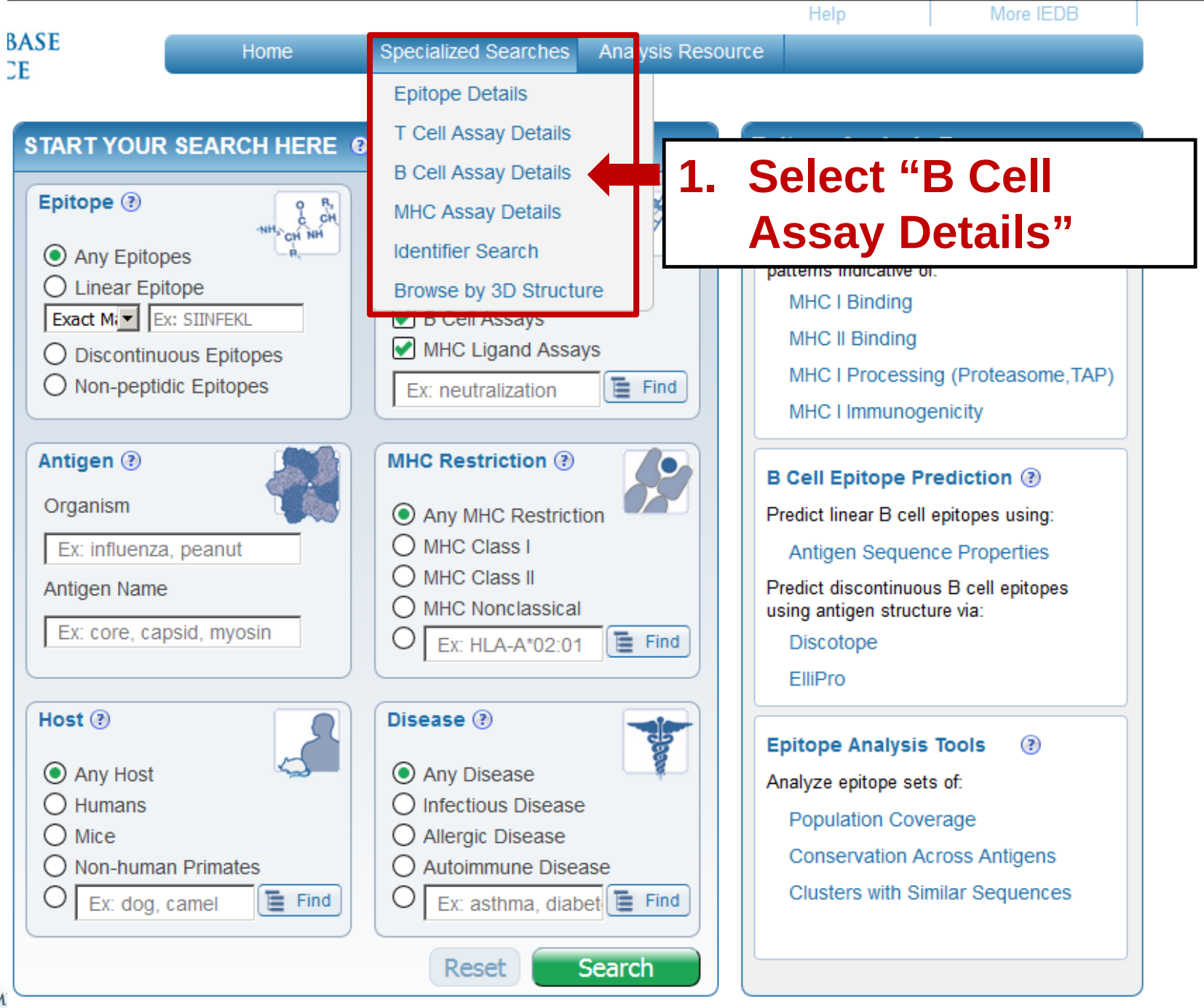
T Cell Assay Information

Immunization	
Host Organism ID:	10000067
Host Organism:	Mus musculus C57BL/6
1st In Vivo Process	
In Vivo Process Type:	Administration in vivo
Administration Details	
Dose Schedule:	1
1st Immunogen	
Epitope Relation:	Structurally Related
Object Type:	Organism
Organism ID:	11320
Organism:	Influenza A virus
Immunogen Details	
Immunogen Evidence Code:	Representative selection
Immunogen Reference Name:	Influenza A virus
In Vitro Administration	
In Vitro Process Type:	Restimulation in vitro
Responder Cell Type:	Splenocyte
Stimulator Cell Type:	Splenocyte
In Vitro Immunogen	
Epitope Relation:	Epitope
Chemical Type:	Linear peptide
Linear Sequence:	ADNENMETM
Immunogen Details	
Immunogen Evidence Code:	Exact match to reference
Immunization Comments	
Immunization Comments:	The route of immunizatior immunization and CTL ge with 1 µM NP 366-374 pe
T Cell Assay	
Qualitative Measurement:	Positive
Method/Technique:	51 chromium release
Measurement of:	cytotoxicity

Effector Cells	
Effector Cell Tissue Type:	Spleen
Effector Cell Type:	Splenocyte
Effector Cell Culture Conditions:	Short Term Restimulated
Antigen Presenting Cells	
Cell Tissue Type:	Lymphoid
Cell Type:	EL-4 cells-Lymphoblast
Cell Culture Conditions:	Cell Line / Clone
Autologous or Syngeneic:	Y
MHC Allele	
MHC Allele Name:	H-2-Db
MHC Evidence Code:	Cited reference
Antigen	
Epitope Relation:	Epitope
Chemical Type:	Linear peptide
Linear Sequence:	ADNENMETM
Antigen Details	
Antigen Evidence Code:	Exact match to reference information
Antigen Reference Name:	D2-hβ2m
Antigen Containing Object	
Complex Type:	Protein conjugate
Molecule Name:	Beta-2-microglobulin precursor
Molecule Accession:	48428791
Molecule Source Organism ID:	9606
Molecule Source Organism:	Homo sapiens
Assay Reference Details	
Assay Comments:	CTL specific for NP 366-374 were co-cultured with EL4 target cells loaded with either 1) D2 peptide plus soluble human β2-microglobulin or 2) a fusion protein comprised of the D2 peptide covalently linked to human β2-microglobulin (D2-hβ2m). Lysis of the two different targets was assessed in a ^{51}Cr-release assay to see if the epitope expressed within the fusion protein could enhance target cell lysis as compared to free peptide. The D2-hβ2m fusion protein induced a higher level of specific lysis than the free peptide at lower peptide/protein concentrations.
Location of Assay Data in Reference:	Figure 4A

Example B Cell Details Search

Find Ebola virus epitopes recognized by neutralizing human monoclonal antibodies.


Help
More IEDB
BASE
CE
Home
Specialized Searches
Analysis Resource
Epitope Details
T Cell Assay Details
B Cell Assay Details
MHC Assay Details
Identifier Search
Browse by 3D Structure
1. Select "B Cell Assay Details"
START YOUR SEARCH HERE
Epitope
Any Epitopes
Linear Epitope
Exact M
Ex: SIINFEKL
Discontinuous Epitopes
Non-peptidic Epitopes
MHC Ligand Assays
Ex: neutralization
Find
Antigen
Organism
Ex: influenza, peanut
Antigen Name
Ex: core, capsid, myosin
MHC Restriction
Any MHC Restriction
MHC Class I
MHC Class II
MHC Nonclassical
Ex: HLA-A*02:01
Find
Host
Any Host
Humans
Mice
Non-human Primates
Ex: dog, camel
Find
Disease
Any Disease
Infectious Disease
Allergic Disease
Autoimmune Disease
Ex: asthma, diabet
Find
Reset
Search
MHC I Binding
MHC II Binding
MHC I Processing (Proteasome,TAP)
MHC I Immunogenicity
B Cell Epitope Prediction
Predict linear B cell epitopes using:
Antigen Sequence Properties
Predict discontinuous B cell epitopes using antigen structure via:
Discotope
ElliPro
Epitope Analysis Tools
Analyze epitope sets of:
Population Coverage
Conservation Across Antigens
Clusters with Similar Sequences

IMMUNE EPITOPE DATABASE AND ANALYSIS RESOURCE

Home | Specialized Searches | Analysis Resource

B Cell Detailed Search

Reset | Search

Pending Filters: Epitope Organisms: Ebolavirus (ID:186536)

Epitopes (319526) | Antigens (4118)

Epitope

Epitope ID: Ex: 44920

Structure Type - Any Epitopes

Organism: Ebolavirus (ID:186536) Finder

Antigen Name: Ex: core, capsid, myosin Finder

1

Epitope Reference Details

Epitope Related Object

Host

Host Organism

Host Details

1st In Vivo Process

1st Immunogen

2nd In Vivo Process

2nd Immunogen

Immunization Com...

Adoptive Transfer

Assay

2. Select epitope organism

		Antigen
		A4 protein
	>3)-[beta-D-galactosyl-(1->3)-N-acetyl-eta-D-galactosyl-(1->4)-beta-D-glucosyl-	
138831	beta-D-Gal-(1->3)-beta-D-GalNAc-(1->4)-[alpha-Neu5Ac-(2->8)-alpha-Neu5Ac-(2->3)]-beta-D-Gal-(1->4)-beta-D-Glc-(1<->1')-Cer	
112741	2,4-dinitrophenyl group	
115013	alpha-D-galactosyl-(1->3)-D-galactose	
115020	benzylpenicilloyl group	
43242	NANPNANPNANP	Circumsporozoite (CS) protein
116864	phosphatidylethanolamine	
112742	2,4,6-trinitrophenyl group	
115009	phosphocholine	
135393	phosphatidylcholine(1+)	
138830	beta-D-Gal-(1->3)-beta-D-GalNAc-(1->4)-beta-D-Gal-(1->4)-beta-D-Glc-(1<->1')-Cer	
114070	benzylpenicillin	

IMMUNE EPITOPE DATABASE AND ANALYSIS RESOURCE

Home | Specialized Searches | Analysis Resource

B Cell Detailed Search

Reset | Search

Epitope

Epitope ID

Structure Type - Any

Organism

Antigen Name

Epitope Referenc…

Epitope Related …

Host

Host Organism: Homo sapiens (human) (ID: Finder (1)

Host Details

1st In Vivo Process

1st Immunogen

2nd In Vivo Process

2nd Immunogen

Immunization Comments

Adoptive Transfer

Assay

Qualitative Measurement

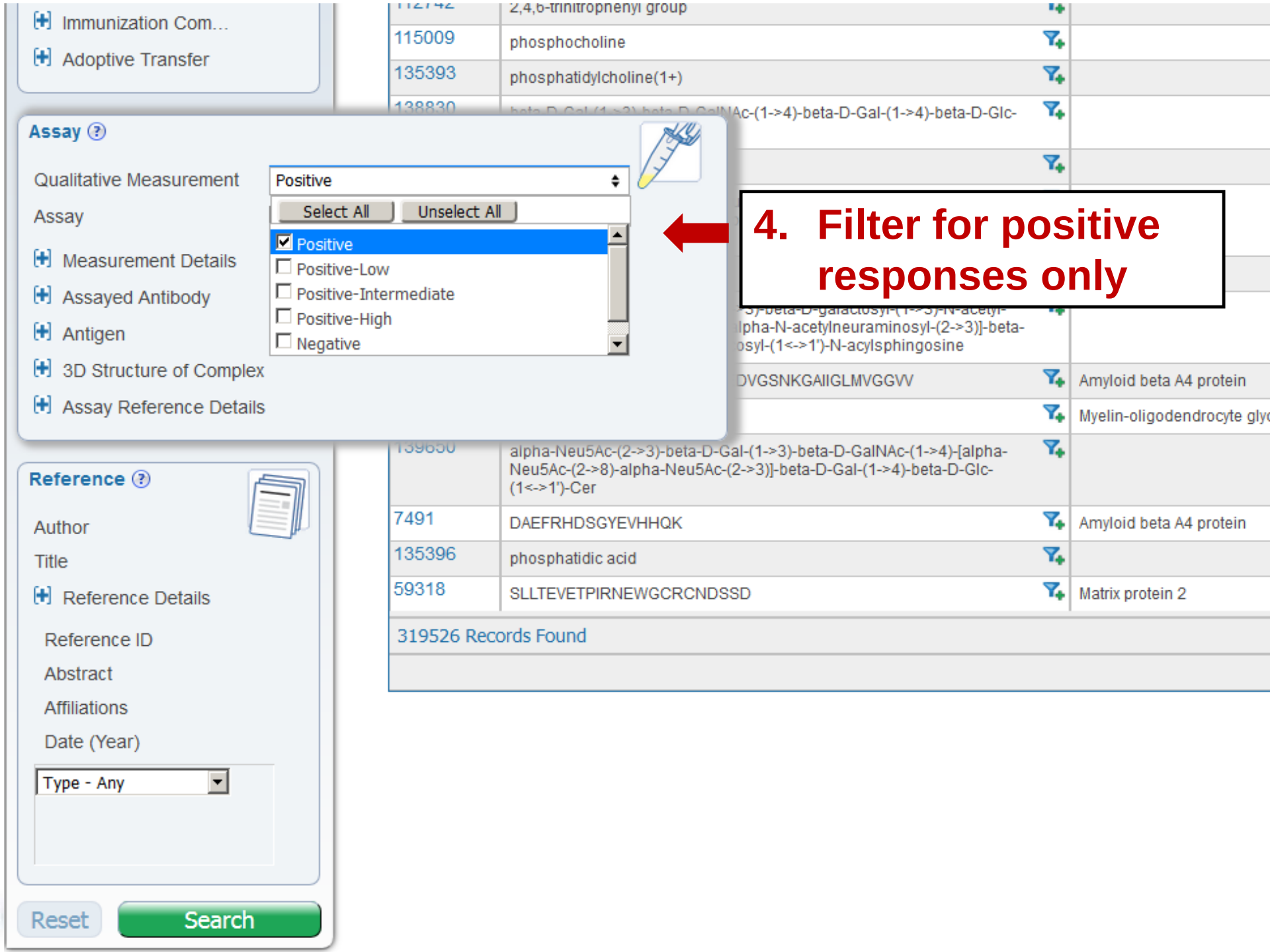
Pending Filters: Epitope Organisms: Ebolavirus (ID:186536) | Host Organism: Homo sapiens (human) (ID:9606, Hor

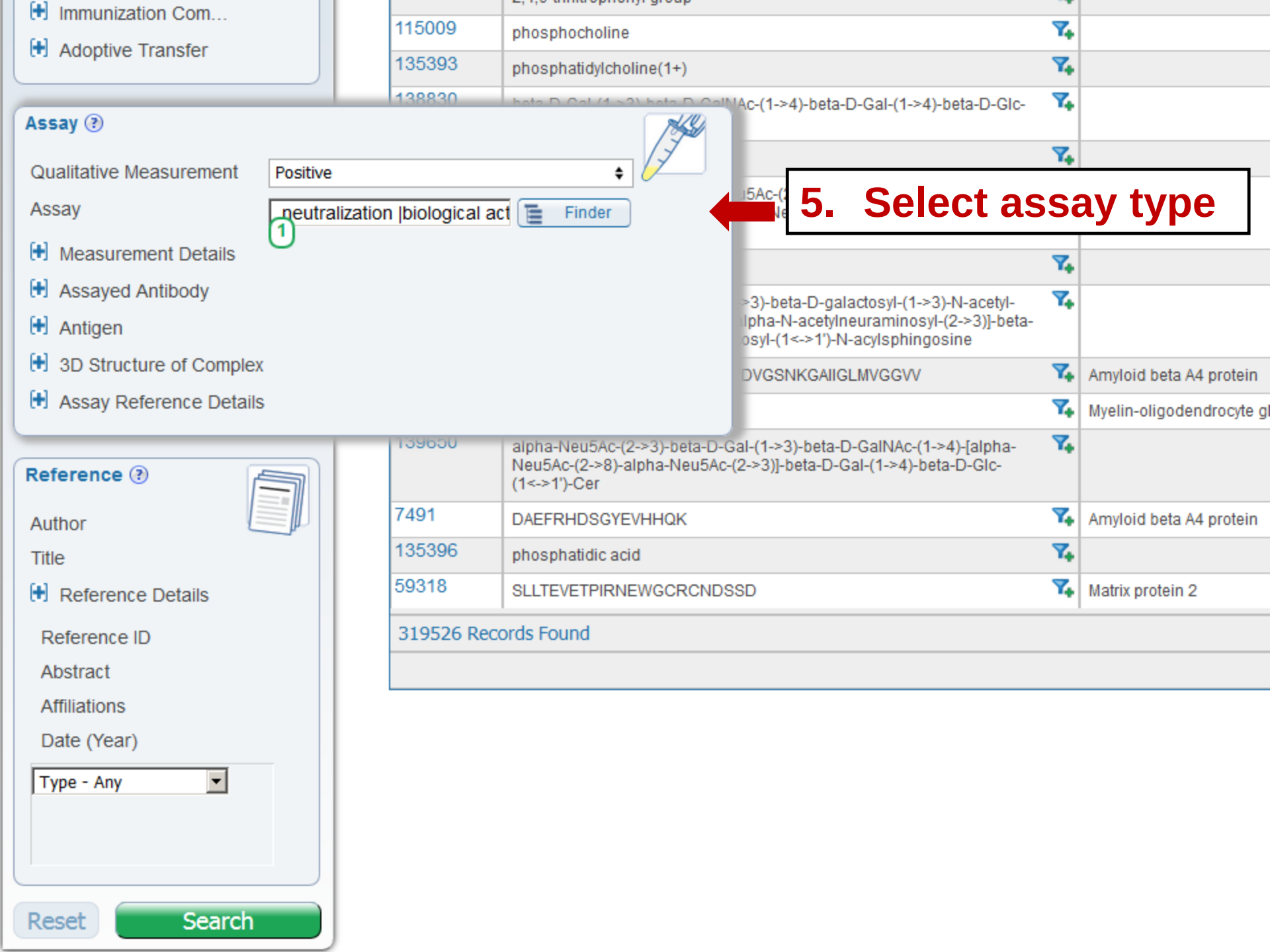
Epitopes (319526) | Antigens (4118)

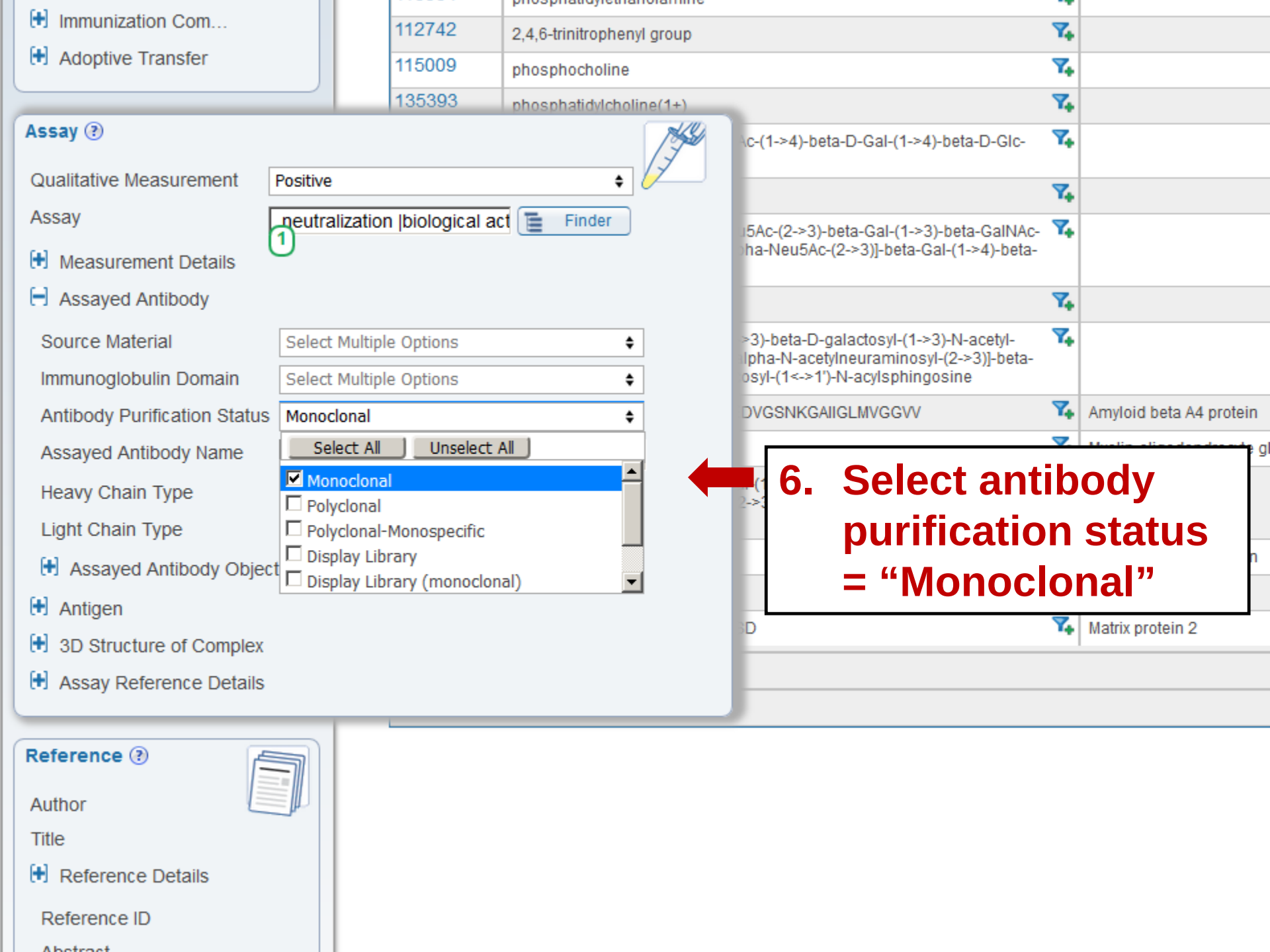
319526 Records Found

Details	Epitope	Antigen
123885	cardiolipin	
130649	alpha-D-Galp-(1->3)-beta-D-Galp-(1->4)-D-GlcpNAc-yl group	
7493	DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA	Amyloid beta A4 protein
135391	phosphatidyl-L-serine	
137345	alpha-N-acetylneuraminosyl-(2->3)-[beta-D-galactosyl-(1->3)-N-acetyl-beta-D-galactosaminyl-(1->4)]-beta-D-galactosyl-(1->4)-beta-D-glucosyl-	
		Circumsporozoite (CS) protein
138830	beta-D-Gal-(1->3)-beta-D-GalNAc-(1->4)-beta-D-Gal-(1->4)-beta-D-Glc-(1<->1')-Cer	
114070	benzylpenicillin	

3. Select host organism


Immunization Com...
Adoptive Transfer
Assay
Qualitative Measurement
Positive
Assay
Select All
Unselect All
Positive
Positive-Low
Positive-Intermediate
Positive-High
Negative
Measurement Details
Assayed Antibody
Antigen
3D Structure of Complex
Assay Reference Details
4. Filter for positive responses only
Reference
Author
Title
Reference Details
Reference ID
Abstract
Affiliations
Date (Year)
Type - Any
Reset
Search
2,4,6-trinitrophenyl group
115009
phosphocholine
135393
phosphatidylcholine(1+)
Ac-(1->4)-beta-D-Gal-(1->4)-beta-D-Glc-
DVGSNKGAIIGLMVGGVV
Amyloid beta A4 protein
Myelin-oligodendrocyte glyc
alpha-Neu5Ac-(2->3)-beta-D-Gal-(1->3)-beta-D-GalNAc-(1->4)-[alpha-Neu5Ac-(2->8)-alpha-Neu5Ac-(2->3)]-beta-D-Gal-(1->4)-beta-D-Glc-(1<->1')-Cer
7491
DAEFRHDSGYEVHHQK
Amyloid beta A4 protein
135396
phosphatidic acid
59318
SLLTEVETPIRNEWGCRCNDSSD
Matrix protein 2
319526 Records Found


Immunization Com...
Adoptive Transfer
Assay
Qualitative Measurement
Positive
Assay
neutralization |biological act
1
Finder
Measurement Details
Assayed Antibody
Antigen
3D Structure of Complex
Assay Reference Details
5. Select assay type
Reference
Author
Title
Reference Details
Reference ID
Abstract
Affiliations
Date (Year)
Type - Any
Reset
Search
115009
phosphocholine
135393
phosphatidylcholine(1+)
-(1->4)-beta-D-Gal-(1->4)-beta-D-Glc-
DVGSNKGAIIGLMVGGVV
Amyloid beta A4 protein
Myelin-oligodendrocyte gl
alpha-Neu5Ac-(2->3)-beta-D-Gal-(1->3)-beta-D-GalNAc-(1->4)-[alpha-Neu5Ac-(2->8)-alpha-Neu5Ac-(2->3)]-beta-D-Gal-(1->4)-beta-D-Glc-(1<->1')-Cer
7491
DAEFRHDSGYEVHHQK
Amyloid beta A4 protein
135396
phosphatidic acid
59318
SLLTEVETPIRNEWGCRCNDSSD
Matrix protein 2
319526 Records Found


Immunization Com...
Adoptive Transfer
112742
2,4,6-trinitrophenyl group
115009
phosphocholine
135393
phosphatidylcholine(1+)
Assay
Qualitative Measurement
Positive
Assay
neutralization |biological act
Finder
1
Measurement Details
Assayed Antibody
Source Material
Select Multiple Options
Immunoglobulin Domain
Select Multiple Options
Antibody Purification Status
Monoclonal
Assayed Antibody Name
Select All
Unselect All
Heavy Chain Type
Light Chain Type
Assayed Antibody Object
Monoclonal
Polyclonal
Polyclonal-Monospecific
Display Library
Display Library (monoclonal)
Antigen
3D Structure of Complex
Assay Reference Details
Amyloid beta A4 protein
Matrix protein 2
6. Select antibody purification status = “Monoclonal”
Reference
Author
Title
Reference Details
Reference ID

Current Filters: Epitope Organisms: Ebolavirus (ID:186536) | Host Organism: Homo sapiens (human) (ID:9606, Homo sapian) | assay-qualitative_measurement: Positive | assay-assay_b_cell_data: neutralization |biological activity (neutralization) | Assayed Antibody Purification Status: Monoclonal

Epitopes (15) | Antigens (2) | Assays (39) | References (5)

Go To Records Starting At 1200 GO — Export Results

15 Records Found — Page 1 of 1 — 25 Per Page

Details	Epitope	Antigen	Organism	# References	# Assays
500035	IWKVNPTVD	spike glycoprotein	Bundibugyo ebolavirus	1	1
502007	RSNTTGTLIWKV	spike glycoprotein	Bundibugyo ebolavirus	1	1
502927	TIYTNGRR	spike glycoprotein	Bundibugyo ebolavirus	1	1
503951	L273, W275	spike glycoprotein	Bundibugyo ebolavirus	1	3
503952	W275	spike glycoprotein	Bundibugyo ebolavirus	1	3
503953	Y241, W275	spike glycoprotein	Bundibugyo ebolavirus	1	3
534854	K114, K115, P116, D117, G118, E120, S142, G143, T1...	Envelope glycoprotein	Zaire ebolavirus	1	1
539006	Q508, C511, N550, D552	Envelope glycoprotein	Zaire ebolavirus	1	1
606555	E231, R247, L254, G271, K272, P279	Envelope glycoprotein	Zaire ebolavirus	1	4
606556	G528	Envelope glycoprotein	Zaire ebolavirus	1	5
606557	H628, D632	Envelope glycoprotein	Zaire ebolavirus	1	3
606558	K510	Envelope glycoprotein	Zaire ebolavirus	1	3
769835	D624	spike glycoprotein	Bundibugyo ebolavirus	1	3
769836	D624, D632	spike glycoprotein	Bundibugyo ebolavirus	1	3
769837	K633	spike glycoprotein	Bundibugyo ebolavirus	1	4

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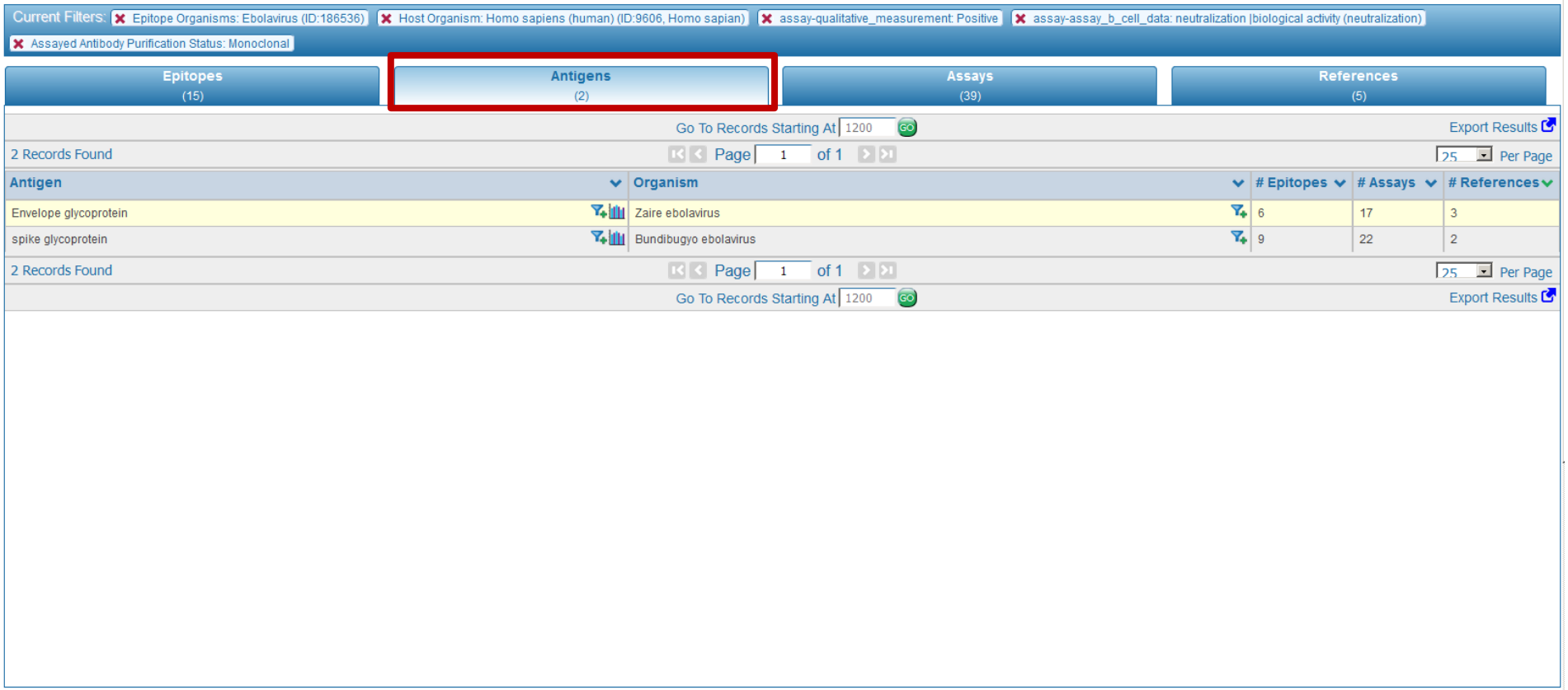
Current Filters:
Epitope Organisms: Ebolavirus (ID:186536)
Host Organism: Homo sapiens (human) (ID:9606, Homo sapian)
assay-qualitative_measurement: Positive
assay-assay_b_cell_data: neutralization |biological activity (neutralization)
Assayed Antibody Purification Status: Monoclonal
Epitopes (15)
Antigens (2)
Assays (39)
References (5)
Go To Records Starting At 1200 GO
Export Results
2 Records Found
Page 1 of 1
25 Per Page
Antigen
Organism
Epitopes
Assays
References
Envelope glycoprotein
Zaire ebolavirus
6
17
3
spike glycoprotein
Bundibugyo ebolavirus
9
22
2
2 Records Found
Page 1 of 1
25 Per Page
Go To Records Starting At 1200 GO
Export Results

Current Filters: Epitope Organisms: Ebolavirus (ID:186536) | Host Organism: Homo sapiens (human) (ID:9606, Homo sapian) | assay-qualitative_measurement: Positive | assay-assay_b_cell_data: neutralization |biological activity (neutralization) | Assayed Antibody Purification Status: Monoclonal

Epitopes (15) | Antigens (2) | **Assays (39)** | References (5)

T Cell Assays (0) | B Cell Assays (39) | MHC Ligand Assays (0)

Go To Records Starting At A,b GO | Export Results

39 Records Found | Page 1 of 2 | 25 Per Page

ID	Reference	Epitope	Host	Immunization	Assay Antigen	Antigen Epitope Relation	Assay Description
3218082	Anna Z Wec; Cell 2017	G528 GP Zaire ebolavirus	Homo sapiens	Infectious disease via exposure to Zaire ebolavirus (Source Organism)	Envelope glycoprotein precursor Envelope glycoprotein precursor Reston ebolavirus - Reston	Taxonomic Sibling	biological activity neutralization **Positive-Intermediate**
3218080	Anna Z Wec; Cell 2017	E231, R247, L254, G271, K272, P279 GP Zaire ebolavirus	Homo sapiens	Infectious disease via exposure to Zaire ebolavirus (Source Organism)	Envelope glycoprotein precursor Envelope glycoprotein precursor Reston ebolavirus - Reston	Taxonomic Sibling	biological activity neutralization **Positive-Intermediate**
2683559	Andrew I Flyak; Cell 2016	L273, W275 envelope glycoprotein Bundibugyo ebolavirus	Homo sapiens	Infectious disease via exposure to Bundibugyo ebolavirus (Source Organism)	Sudan ebolavirus Sudan ebolavirus	Taxonomic Sibling	biological activity neutralization **Positive**
3218077	Anna Z Wec; Cell 2017	E231, R247, L254, G271, K272, P279 GP Zaire ebolavirus	Homo sapiens	Infectious disease via exposure to Zaire ebolavirus (Source Organism)	virion spike glycoprotein virion spike glycoprotein Tai Forest ebolavirus	Taxonomic Sibling	biological activity neutralization **Positive**
2683556	Andrew I Flyak; Cell 2016	RSNTTGTLIWKV envelope glycoprotein (266-277) Bundibugyo ebolavirus	Homo sapiens	Infectious disease via exposure to Bundibugyo ebolavirus (Source Organism)	Bundibugyo ebolavirus Bundibugyo ebolavirus	Source Organism	biological activity neutralization **Positive**
3218071	Anna Z Wec; Cell 2017	H628, D632 GP Zaire ebolavirus	Homo sapiens	Infectious disease via exposure to Zaire ebolavirus (Source Organism)	envelope glycoprotein envelope glycoprotein Bundibugyo ebolavirus	Taxonomic Sibling	biological activity neutralization **Positive**
2683552	Andrew I Flyak; Cell 2016	W275 envelope glycoprotein Bundibugyo ebolavirus	Homo sapiens	Infectious disease via exposure to Bundibugyo ebolavirus (Source Organism)	Bundibugyo ebolavirus Bundibugyo ebolavirus	Source Organism	biological activity neutralization **Positive**
3218072	Anna Z Wec; Cell 2017	H628, D632 GP Zaire ebolavirus	Homo sapiens	Infectious disease via exposure to Zaire ebolavirus (Source Organism)	virion spike glycoprotein virion spike glycoprotein Tai Forest ebolavirus	Taxonomic Sibling	biological activity neutralization **Positive**
2683560	Andrew I Flyak; Cell 2016	Y241, W275 envelope glycoprotein Bundibugyo ebolavirus	Homo sapiens	Infectious disease via exposure to Bundibugyo ebolavirus (Source Organism)	Ebola virus Ebola virus	Taxonomic Sibling	biological activity neutralization **Positive**
3218068	Anna Z Wec; Cell 2017	E231, R247, L254, G271, K272, P279 GP	Homo sapiens	Infectious disease via exposure to Zaire ebolavirus (Source Organism)	GP GP Zaire ebolavirus	Source Antigen	biological activity neutralization **Positive**

Live Demo (KV) - Dengue virus

Once I run a query, how can I best use the data?

a. Navigating the tabs

b. Understanding the summary pages

c. Downloading the results

Live Demo (NS) - Allergy

How would I search for epitopes defined for food allergens?

a. Disease Finder – data tree

b. Antigen Finder

e.g. parvalbumin (Gad m 1; Sal s 1)

Live Demo (KV) – T1D

How would I find data related to type 1 diabetes?

a. patients with diagnosed T1D
b. auto-antigens related to
c. compare mouse and human data

Live Demo (NS) – Linear Epitope Search

How to determine known epitopes from a protein sequence of interest.

Live Demo (NS) - T Cell Details Search

Find *Plasmodium falciparum* T cell epitopes tested specifically on $CD8^+$ T cells and defined in humans.

Live Demo (NS) - T Cell Details Search

- ✓ Find *Plasmodium falciparum* T cell epitopes tested specifically on $CD8^+$ T cells and defined in humans.
- ➡ Have tetramers been made with any of these epitopes and used to detect CD8+ T cells?

Lunch
12:30-1:30pm

Exercises continued…

Participant Exercises

1. What antibody epitopes have been defined for dengue virus in humans? Any mAbs? Protective epitopes?

2. What epitopes have been defined for peanut (*Arachis hypogaea)*?

3. What tetramers have been used in the context of influenza A virus?

Participant Exercise

Find HLA-A*02:01 epitopes tested in MHC binding assays, then find HLA-A*02:01 epitopes defined with MHC elution assays.

If time permits

Live Demo (KV)– Receptor data

How would I identify epitopes TCR-MHC interactions?

a. how many? What diseases?

b. kinetic measurements

c. filtering data