

# Finding Data in the IEDB

## *Using the query interfaces*

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# Overview

## Introduction

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

## Break

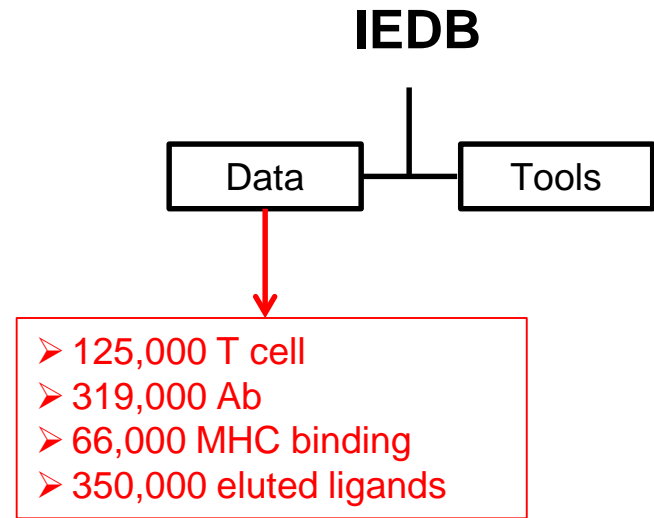
- Immunome Browser
- Example queries & demos (live)

## 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

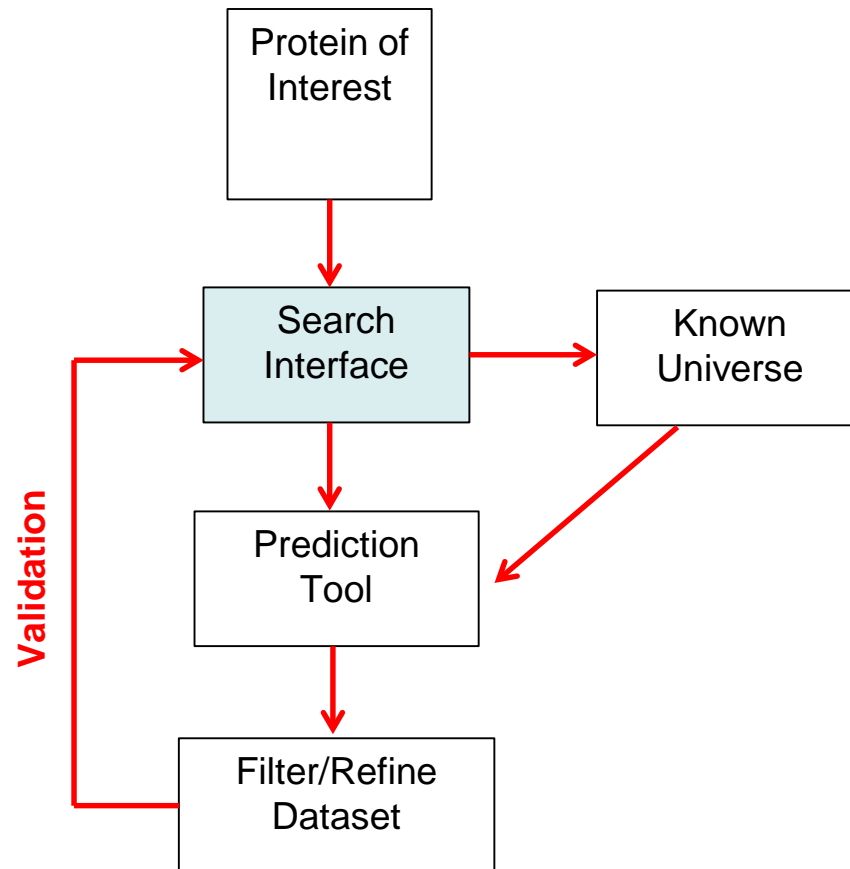


**➔** Helps defines 'known universe'

*What has and has not been done*

**➔** Part of prediction or informatics pipeline

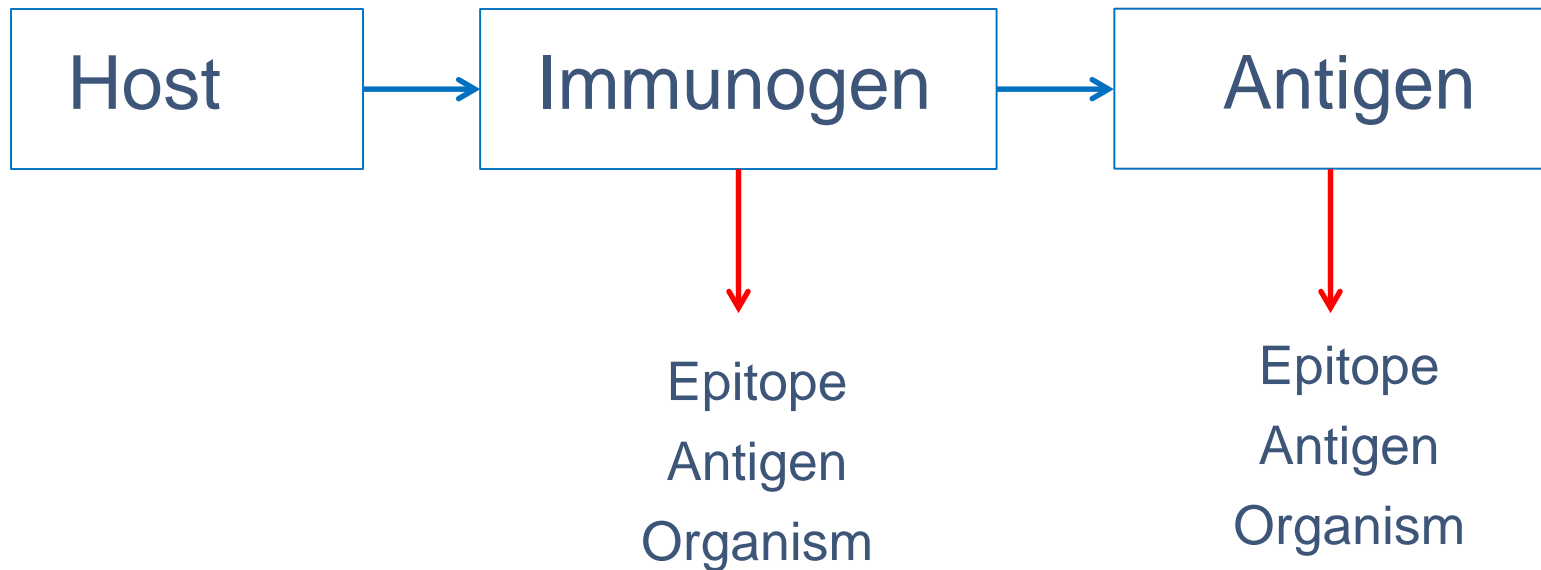
# Maximize the Available Information Pipeline



# 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](http://curationwiki.iedb.org/wiki/index.php/Main_Page)

# Assay-centric nature of the data



# IEDB Home Page

## Welcome

The IEDB is a free resource, funded by a contract from the [National Institute of Allergy and Infectious Diseases](#). It offers easy searching of experimental data characterizing antibody and T cell epitopes studied in humans, non-human primates, and other animal species. Epitopes involved in infectious disease, allergy, autoimmunity, and transplant are included.

The IEDB also hosts tools to assist in [Learn More](#)

**2018  
USER  
WORKSHOP**

22-23 October 2018  
LJI, San Diego, CA, USA  
Information available at  
[workshop.iedb.org](http://workshop.iedb.org)

## Summary Metrics

Peptidic Epitopes	519,565
Non-Peptidic Epitopes	2,685
T Cell Assays	340,275
B Cell Assays	456,121
MHC Ligand Assays	1,054,376
Epitope Source Organisms	3,665
Restricting MHC Alleles	773
References	19,646

## START YOUR SEARCH HERE ?

### Epitope ?

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

Exact Match:



### Antigen ?

Organism

Antigen Name



### Host ?

- Any Host
- Humans
- Mice
- Non-human Primates



### Assay ?

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



### MHC Restriction ?

- Any MHC Restriction
- MHC Class I
- MHC Class II
- MHC Nonclassical



### Disease ?

- Any Disease
- Infectious Disease
- Allergic Disease
- Autoimmune Disease



## Epitope Analysis Resource

### T Cell Epitope Prediction ?

Scan an antigen sequence for amino acid patterns indicative of:

[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 ?

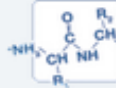
Analyze epitope sets of:

[Population Coverage](#)


[Conservation Across Antigens](#)

[Clusters with Similar Sequences](#)


# Home Page Search Interface

**Epitope** ? 


Any Epitopes  
 Linear Epitope  
Exact M ▾ Ex: SIINFEKL  
 Discontinuous Epitopes  
 Non-peptidic Epitopes

**Assay** ? 


Positive Assays Only  
 T Cell Assays  
 B Cell Assays  
 MHC Ligand Assays  
Ex: neutralization

**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

**Host** ? 

Any Host  
 Humans  
 Mice  
 Non-human Primates  
Ex: dog, camel

**Disease** ? 

Any Disease  
 Infectious Disease  
 Allergic Disease  
 Autoimmune Disease  
Ex: asthma, diabete

*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

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) Antigen (42401) Assays (1206199) Receptors (18292) References (19537)

Go To Records Starting At 1200  
 522250 Records Found Page 1 of 20890

Details	Epitope	Antigen	Organism	# References	# Assays
123885	cardiolipin			320	1028
44920	NLVPMTAV	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-hexacosanoylphosphatidylcholine			117	578
24786	HSLGKWLGHDPKF	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	PKYVQNTLKLAT	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	FLPSDFFPV	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

**Pending Filters**

Reset Search


**Epitope** ?

Any Epitopes

Linear Epitope

Discontinuous Epitopes

Non-peptidic Epitopes



**Current Filters:** ✖ Positive Assays Only


**Epitopes**  
(522321)

522321 Records Found

Details ▾ Epitope

123885	cardiolipin
44920	NLVPMVATV

**References**  
(19554)

Export Results 

25 ▾ Per Page

	# References	# Assays
	320	1028
	275	679

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

	81	254
	80	247
	79	189

25 ▾ Per Page

Export Results 

# Epitope Sequence Search

Default is 'Any' which gives all epitope types

Use radio button to select specific type of structure

Can type in sequence of choice

Epitope ?

Any Epitopes  
 Linear Epitope  
 Discontinuous Epitopes  
 Non-peptidic Epitopes

Exact Matc ▾ Ex: SIINFEKL

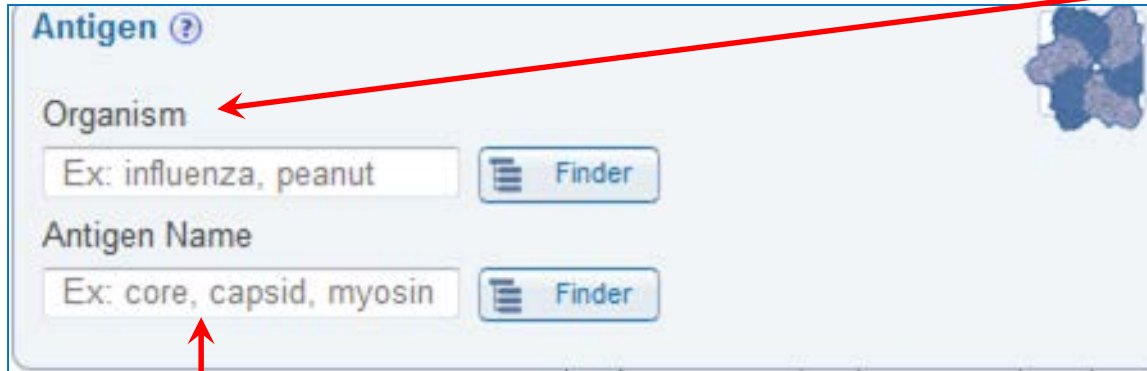
Exact Matches  
Substring  
Blast - 90%  
Blast - 80%  
Blast - 70%

Finder

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

# Antigen Search

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

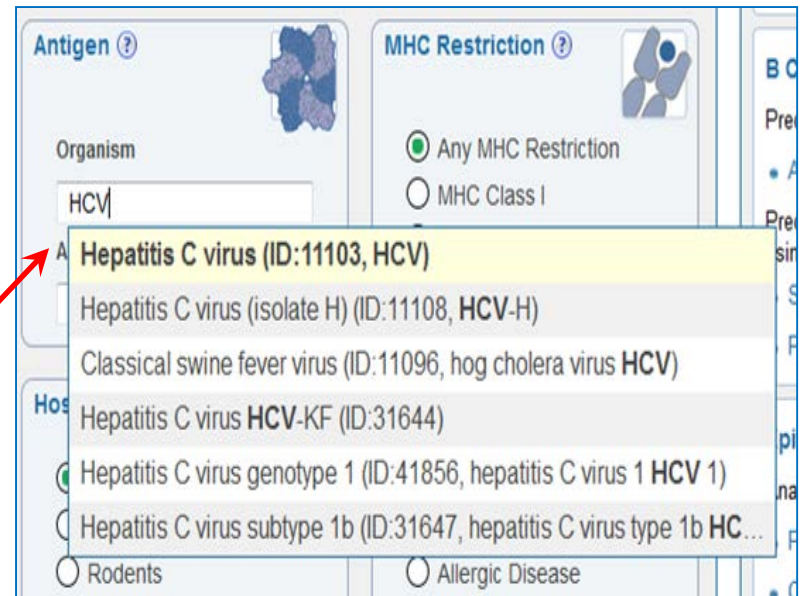


**Antigen** ?

Organism  
Ex: influenza, peanut

Antigen Name  
Ex: core, capsid, myosin

Protein of interest (source of epitope)



**Antigen** ?

Organism  
HCV

**MHC Restriction** ?

Any MHC Restriction  
 MHC Class I

- Hepatitis C virus (ID:11103, HCV)**
- Hepatitis C virus (isolate H) (ID:11108, HCV-H)
- Classical swine fever virus (ID:11096, hog cholera virus HCV)
- Hepatitis C virus HCV-KF (ID:31644)
- Hepatitis C virus genotype 1 (ID:41856, hepatitis C virus 1 HCV 1)
- Hepatitis C virus subtype 1b (ID:31647, hepatitis C virus type 1b HC...)
- Rodents
- Allergic Disease

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

# Receptor Data

BCR heavy-light  
BCR heavy-heavy  
BCR heavy  
BCR scFv  
BCR construct  
BCR light-light  
BCR light  
TCR  $\alpha\beta$   
TCR TscFv

- TCR and BCR
- $\alpha$ ,  $\beta$ , H and L
- CDR1, 2 and 3

**Receptor ?**

Has receptor sequence

Type

---

Chain  Region

Sequence  Ex: CARNTGNQFYF

heavy  
light  
 $\alpha$   
 $\beta$

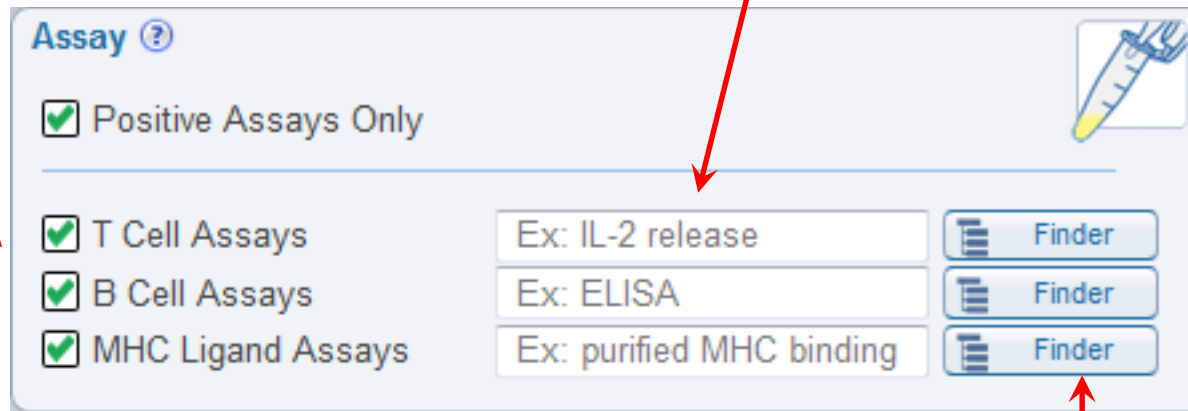
Substring  
Identity - 90%  
Identity - 80%  
Identity - 70%  
Identity - 60%

CDR3  
Full length  
CDR1  
CDR2

# Assay Search

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

Can type in assay of interest (auto-complete)



The screenshot shows the 'Assay' search interface. At the top left, there is a header 'Assay' with a help icon. Below it, there is a checkbox labeled 'Positive Assays Only' which is checked. A red arrow points from the text 'Select response type of interest at 'high level' by checking box' to this checkbox. Below a horizontal line, there are three rows of assay types, each with a checked checkbox, a text input field, and a 'Finder' button. The first row is 'T Cell Assays' with the example 'Ex: IL-2 release'. The second row is 'B Cell Assays' with the example 'Ex: ELISA'. The third row is 'MHC Ligand Assays' with the example 'Ex: purified MHC binding'. A red arrow points from the text 'Can type in assay of interest (auto-complete)' to the first input field. Another red arrow points from the text 'Click open Finder to access data tree if you cannot immediately find the one you want' to the 'Finder' button of the third row. In the top right corner of the interface, there is an icon of a test tube.

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

MHC Restriction ?

Any MHC Restriction

MHC Class I

MHC Class II

MHC Nonclassical

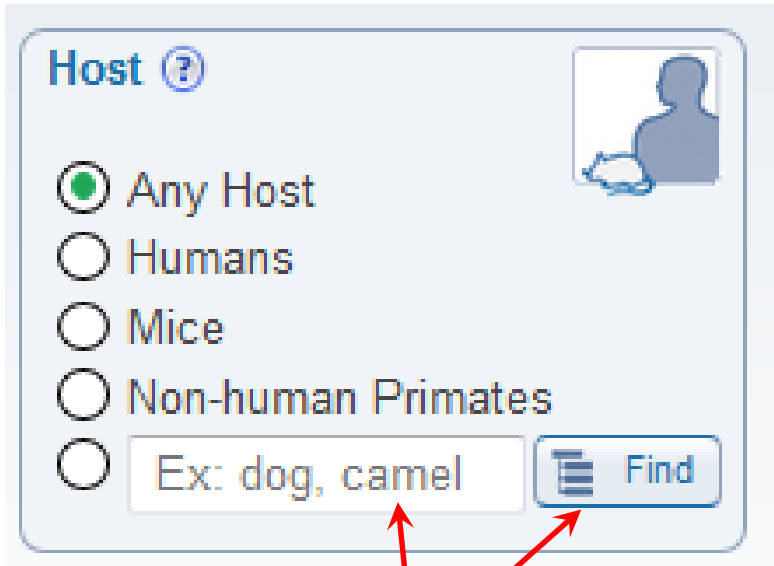
Specific MHC Restrict...

Ex: HLA-A\*02:01, H-2-Kb

Finder

Use **Finder** to explore specific alleles

# Host Search



Host ?

Any Host

Humans

Mice

Non-human Primates

Ex: dog, camel

Find

Search for host of interest

- Human data
- Animal models

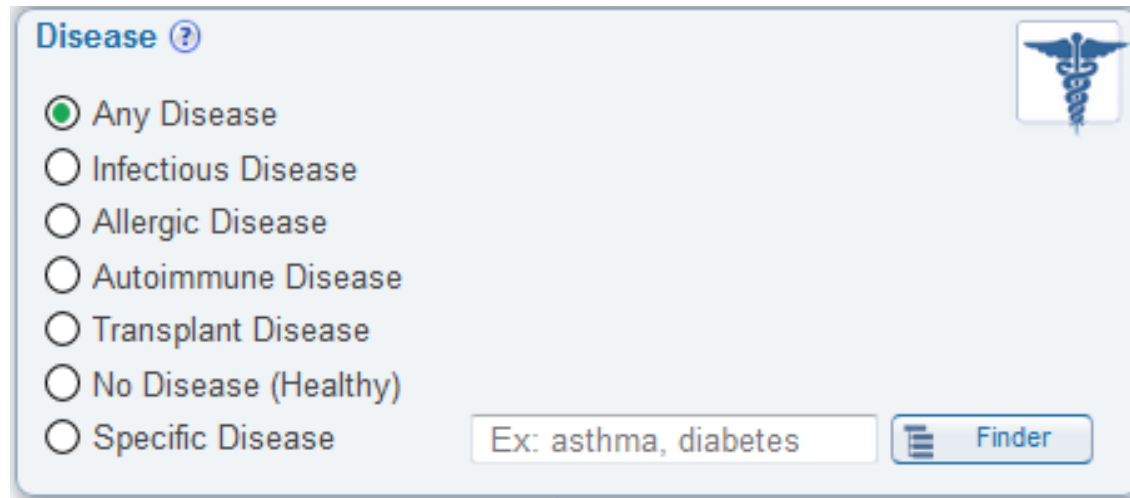
Can use text box or **Finder** to select certain unique species



# Search by Disease

Represents clinical status of a host:

- Patient history
- Known animal models of disease



**Disease** ?

Any Disease

Infectious Disease

Allergic Disease

Autoimmune Disease

Transplant Disease

No Disease (Healthy)

Specific Disease

Ex: asthma, diabetes

Finder


Unique feature

- Allergy
- Autoimmunity
- Healthy controls

Can assess differential reactivity

- Animal model v. human

# Reference Search

**Reference** 

Any Reference Type  
 Journal Article

PubMed ID

Submission

Author

Title

Date (Year)

NCBI Resources  How To

PubMed.gov

US National Library of Medicine  
National Institutes of Health

Display Settings:  Abstract

[Hum Immunol](#), 2014 May;75(5):440-51. doi: 10.1016/j.humimm.2014.02.013. Epub 2014 Feb 12.

**Substantial gaps in knowledge of Bordetella pertussis antibody and T cell epitopes relevant for natural immunity and vaccine efficacy.**

Vaughan K<sup>1</sup>, Sevmour E<sup>2</sup>, Peters B<sup>2</sup>, Sette A<sup>2</sup>.

**Author information**

**Abstract**

The recent increase in whooping cough in vaccinated populations has been attributed to waning immunity associated with the acellular vaccine. The Immune Epitope Database (IEDB) is a repository of immune epitope data from the published literature and includes T cell and antibody epitopes for human pathogens. The IEDB conducted a review of the epitope literature, which revealed 300 Bordetella pertussis-related epitopes from 39 references. Epitope data are currently available for six virulence factors of B. pertussis: pertussis toxin, pertactin, fimbrial 2, fimbrial 3, adenylate cyclase and filamentous hemagglutinin. The majority of epitopes were defined for antibody reactivity; fewer T cell determinants were reported. Analysis of available protective correlates data revealed a number of candidate epitopes; however few are defined in humans and few have been shown to be protective. Moreover, there are a limited number of studies defining epitopes from natural infection versus whole cell or acellular/subunit vaccines. The relationship between epitope location and structural features, as well as antigenic drift (SNP analysis) was also investigated. We conclude that the cumulative data is yet insufficient to address many fundamental questions related to vaccine failure and this underscores the need for further investigation of B. pertussis immunity at the molecular level.

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PMID: 24530743 [PubMed - in process]

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)

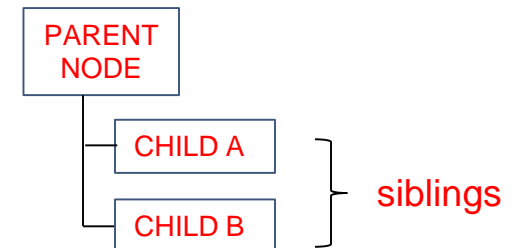
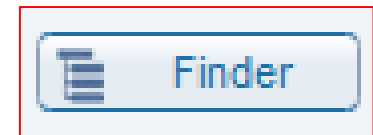
Non-proteins (ChEBI)

Organisms (NCBI taxonomy)

Alleles (MRO)

Assays (BAO)

Disease (Disease Ontology, DO ids)



# Accessing Finders

## Home Page

**Epitope** ?

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

**Assay** ?

Positive Assays Only  
 T Cell Assays  
 B Cell Assays  
 MHC Ligand Assays  
Ex: neutralization

**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

**Host** ?

Any Host  
 Humans  
 Mice  
 Non-human Primates  
Ex: dog, camel

**Disease** ?

Any Disease  
 Infectious Disease  
 Allergic Disease  
 Autoimmune Disease  
Ex: asthma, diabete

## Results Page

Pending Filters:

Current Filters:  Positive Assays Only

**Epitopes** (522321)

**Epitope** ?

Any Epitopes  
 Linear Epitope  
 Discontinuous Epitopes  
 Non-peptidic Epitopes  
Exact Matc   
Ex: penicillin

3D structure available  
Amino Acid Modification

**Antigen** ?

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

**Receptor** ?

Has receptor sequence  
Type   
Chain   
Sequence

**Assay** ?

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

**MHC Restriction** ?

Any MHC Restriction

50560	SIINFEKL
4602	ASNENMETM
112741	2,4-dinitrophenyl group
20788	GLCTLVA
130694	1-O-(alp
24786	HSLGKW
130649	alpha-D-
48237	PKYVKK
112742	2,4,6-trinitrophenyl group
6435	CINGVCWTV
32208	KLVALGINAV
53112	RAHYNVTF
61086	SSIEFARL
61151	SLENFRAYV
16833	FLPSDFPSPV
30001	KAVYNFATC
65748	TPRVTGGGAM
6568	CLGGLTMV
7493	DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA
16878	FLRGRAYGL
17516	FQPQNGQFI

522321 Records Found

Mouse over pane to expand

# Non-Peptidic Epitope Finder

**Epitope ?**

Any Epitopes

Linear Epitope

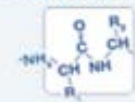
Discontinuous Epitopes

Non-peptidic Epitopes

Exact Matc Ex: SIINFEKL

Ex: penicillin

**Finder**



Non-protein chemical entities

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

Click 'Finder' to open (below)

Current Selection(s) Reset Apply

**Search By**

Name: cardiopin

Molecule ID: Ex: 17334

Clear Search

Type name

**Browse by Tree (Click to Select)**

- non-peptidic material
  - atom
  - chemical substance
  - group (part of molecule)
  - molecule other than protein

Chemical Data Tree

Click to generate list of possible chemical entities

Search Results (Click to Select)

13 Records Found Page 1 of 3 5 Per Page

Molecule Name	Synonyms	Database ID	Organism Name
cardiolipin	CARDIOLIPIN, 1',3'-bis(1,2-diacyl-sn-glycero-3-phospho)-sn-glycerol, Cardiolipin, Diphosphatidylglycerol, cardiolipins, DPG, 1',3'-Bis(1,2-diacyl-sn-glycero-3-phospho)-sn-glycerol	ChEBI:28494	
diphosphatidyl propylene glycol	DPPG, deoxycardiopin, 2'-deoxycardiopin	ChEBI:60358	
reduced cardiolipin	reduced cardiolipins, hydrocardiolipin, CLred	ChEBI:60457	
acetyl cardiolipin	2'-O-acetyl-1',3'-bis(1,2-diacyl-sn-glycero-3-phospho)-sn-glycerol, acetylcardiolipin	ChEBI:60353	
2,2'-dilyso cardiopin	2,2'-dilyso cardiopin, 2,2'-dilyso-1,3-diphosphatidylglycerol, 2,2'-dilyso diphosphatidyl glycerol, 2,2'-dilyso DPG, 2,2'-dilyso diphosphatidylglycerol, dilyso cardiopin	ChEBI:60431	

13 Records Found Page 1 of 3 5 Per Page

# Organism Finder

**Antigen** ?

Organism  
Ex: influenza, peanut

Antigen Name  
Ex: core, capsid, myosin

Links to NCBI taxonomy

Used to search for:

- epitope source
- immunogen if organism
- assay antigen

Click 'Finder' to open (below)

**Search By**

Name: leishmania  
Organism ID: 10002045

Type name

**Browse by Tree (Click to Select)**

- Root
  - Organism
  - Unidentified
  - other sequences

Open tree to search by taxonomic group – bacteria, viruses or eukaryotes

Click to generate list of possible organisms

**Search Results (Click to Select)**

20 Records Found 5 Per Page

Organism Name	Synonyms	Organism ID
Leishmania	Leishmania	5658 <a href="#">🔗</a>
Leishmania major	Leishmania major, Leishmania tropica major, Leishmania (Leishmania) major	5664 <a href="#">🔗</a>
Leishmania pifanoi	Leishmania pifanoi, Leishmania pifani, Leishmania (Leishmania) pifanoi	5682 <a href="#">🔗</a>
Leishmania braziliensis	Leishmania braziliensis, Leishmania (Viannia) braziliensis, Leishmania brasiliensis, Leishmania viannia	5660 <a href="#">🔗</a>
Leishmania chagasi	Leishmania chagasi, Leishmania chagasi subsp. chagasi, Leishmania chagasi chagasi, Leishmania (Leishmania) chagasi, Leishmania donovani chagasi, Leishmania infantum chagasi	44271 <a href="#">🔗</a>

20 Records Found 5 Per Page

# Organism Finder

Current Selection(s) ✕ Leishmania chagasi Reset Apply

**Search By**

Name:

Organism ID:

**Browse by Tree (Click to Select)**

- Leishmania
- Leishmania aethiopica
- Leishmania braziliensis
- Leishmania donovani species complex
- Leishmania major
- Leishmania mexicana species complex
- Leishmania panamensis
- Trypanosoma
- Viridiplantae (green plants)

Click 'highlight in tree' to see breakdown of available genotypes

**Search Results (Click to Select)**

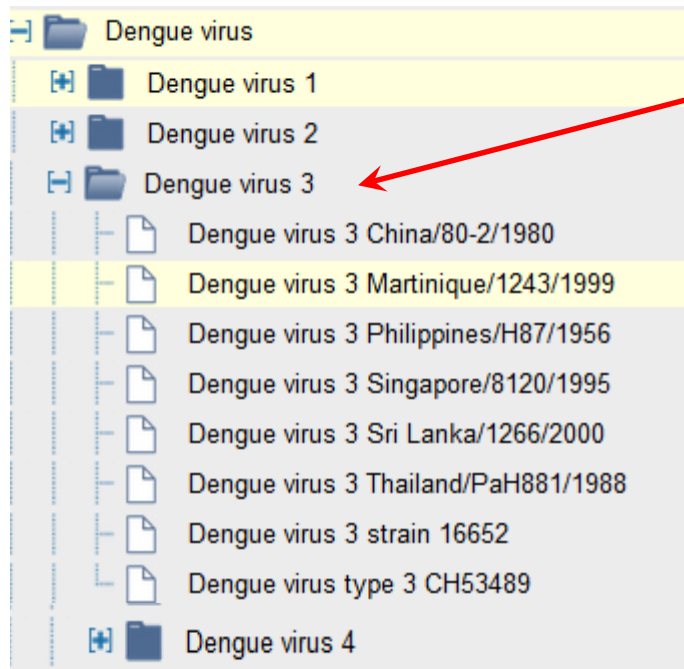
20 Records Found Page 1 of 4 5 Per Page

Organism Name	Synonyms	Organism ID
Leishmania	Leishmania	5658
Leishmania major	Leishmania major, Leishmania tropica major, Leishmania (Leishmania) major	5664
Leishmania pifanoi	Leishmania pifanoi, Leishmania pifani, Leishmania (Leishmania) pifanoi	5682
Leishmania braziliensis	Leishmania braziliensis, Leishmania (Viannia) braziliensis, Leishmania brasiliensis, Leishmania viannia	5660
Leishmania chagasi	Leishmania chagasi, Leishmania chagasi subsp. chagasi, Leishmania chagasi chagasi, Leishmania (Leishmania) chagasi, Leishmania donovani chagasi, Leishmania infantum chagasi	44271

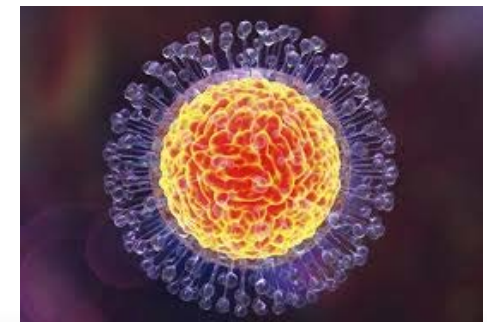
Page 1 of 4 5 Per Page

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

# Example of Organism Data Tree

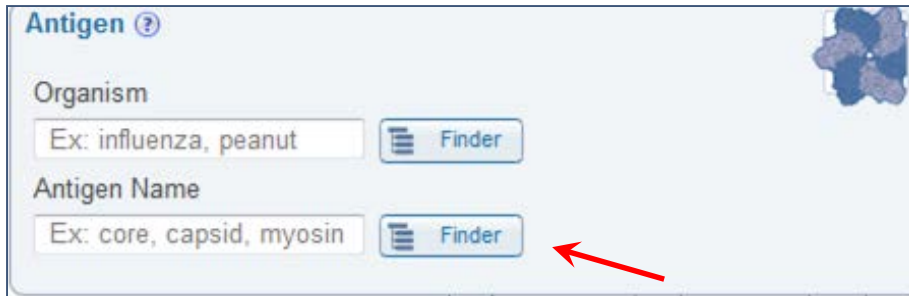


Click to open successive nodes to find specific strain or use high node to look at all available





# Antigen Finder



Antigen ?

Organism  
Ex: influenza, peanut

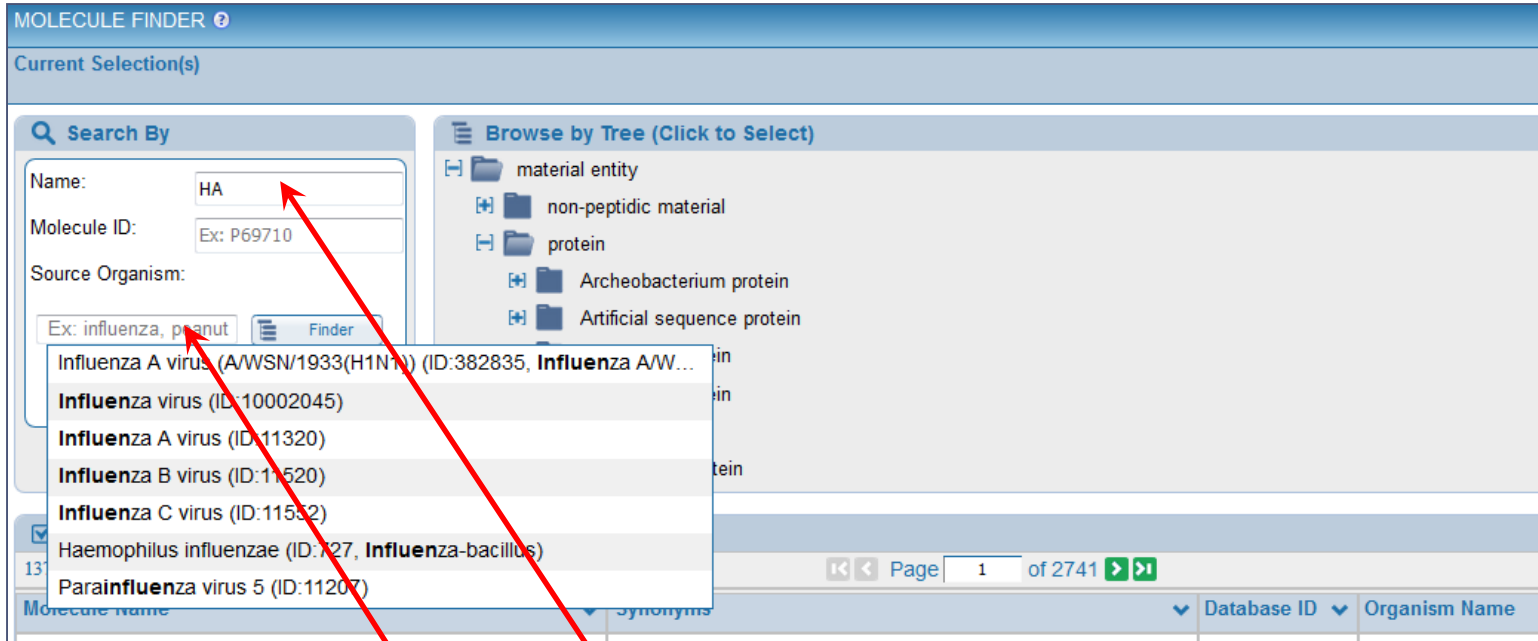
Antigen Name  
Ex: core, capsid, myosin

A red arrow points to the 'Finder' button next to the Antigen Name field.

Click 'Finder' to open (below)

Links to NCBI GenPept  
Used to search for:

- epitope source
- immunogen if protein
- assay antigen source



MOLECULE FINDER

Current Selection(s)

Search By

Name: HA

Molecule ID: Ex: P69710

Source Organism: Ex: influenza, peanut

Browse by Tree (Click to Select)

- material entity
  - non-peptidic material
  - protein
    - Archeobacterium protein
    - Artificial sequence protein

Search results:

- Influenza A virus (A/WSN/1933(H1N1)) (ID:382835, Influenza A/W...
- Influenza virus (ID:10002045)
- Influenza A virus (ID:11320)
- Influenza B virus (ID:11520)
- Influenza C virus (ID:11532)
- Haemophilus influenzae (ID:727, Influenza-bacillus)
- Parainfluenza virus 5 (ID:11207)

Page 1 of 2741

Database ID Organism Name

A red arrow points from the 'Finder' button in the search form to the search results list.

Type protein and organism

# Antigen Finder

**Search By**

Name:

Molecule ID:

Source Organism:

**Browse by Tree (Click to Select)**

- material entity
  - non-peptidic material
  - protein
    - Archeobacterium protein
    - Artificial sequence protein
    - Bacterium protein
    - Eukaryote protein
    - Plasmid protein

**Search Results (Click to Select)**

70 Records Found Page 1 of 14

Molecule Name	Synonyms	Database ID	Organism Name
haemagglutinin [SRC293731]	hemagglutinin, HA	IEDB [293731]	Influenza A virus
Hemagglutinin ★★ ?	HA2, HA1, Hemagglutinin precursor, hemagglutinin H5, Chain A, Crystal Structure Of Broadly Neutralizing Antibody F045-092 In Complex With A/Victoria/361/2011 (h3n2) Influenza Hemagglutinin, heamagglut ...more...	UniProt [P03452]	Influenza A virus
hemagglutinin gene [2271249]	HA	GenPept [2271249]	Influenza A virus
hemagglutinin gene [2271251]	HA	GenPept [2271251]	Influenza A virus
hemagglutinin gene [2271273]	HA1, HA	GenPept [2271273]	Influenza A virus

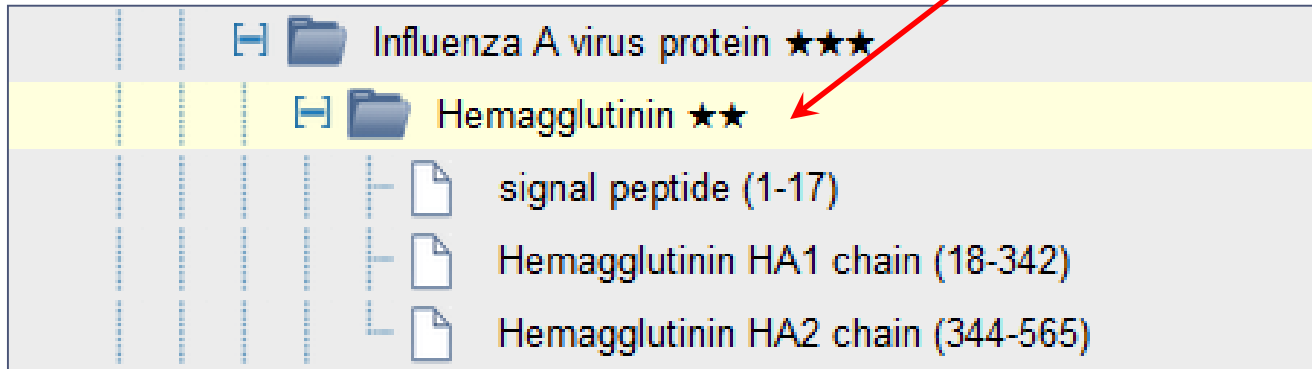
70 Records Found

**Use top row to sort**


**Click Highlight in Tree to see what's available**

# Example of Antigen Tree

Click high node 'Hemagglutinin' to retrieve **all** HA from all flu



# Receptors search (no finder)

Receptor ? 

Has receptor sequence


Type

---

Chain  Region

Sequence  Ex: CARNTGNQFYF

 18,292 total

Receptor ? 


Has receptor sequence

Type

---

Chain  Region

Sequence  Ex: CARNTGNQFYF

 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	IVRSSNTGKLI	ASSQDRDTQY	
49	📄+ Mus musculus (mouse)	αβ	AASANSPTYQR	ASGDAGGGYEYQ	
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	AANSPTYQR	ASGDFWGDPLY	
109	📄+ Homo sapiens (human)	αβ	IWGGYQKVT	ASRYRDDSNEYQF	
110	📄+ Homo sapiens (human)	αβ	AVTTDSWGKLLQ	ASRPLAGGRPEYQ	
111	📄+ Homo sapiens (human)	αβ	AVTTDSWGKLLQ	ASRPLMSAQPEYQ	
114	📄+ Mus musculus (mouse)	αβ	AVSDPPPLLT	ASGGGGTLY	
115	📄+ Mus musculus (mouse)	αβ	AVSLERPPLYT	ASGGGGTLY	
116	📄+ Homo sapiens (human)	αβ	ALSGFYNTDKLI	ASPGLAGEYEYQ	
117	📄+ Homo sapiens (human)	αβ	AVRPTSGGSYIPT	ASSYVGNTEGELF	
118	📄+ Mus musculus (mouse)	αβ	ALFLASSSFSKLV	ASSDWVSYEYQ	
125	📄+ Homo sapiens (human)	αβ	ATDTSPTYKYI	SARDLTSGANNEQF	

# Assay Finder

**Assay ?**

Positive Assays Only

T Cell Assays      Ex: IL-2 release      **Finder**

B Cell Assays      Ex: ELISA      **Finder**

MHC Ligand Assays      Ex: purified MHC binding      **Finder**

Find specific assay within broader category

- Neutralization
- Cytolysis (BrdU v. <sup>51</sup>Cr)
- IFN $\gamma$  ELISPOT

ASSAY FINDER

Current Selection(s) Reset Apply

**Search By**

Name: Ex: IL-2, Release

Method/Techniq... (circled in red)

Measurement Of:

Units:

Clear Search

**Browse by Tree (Click to Select)**

- T cell assay
  - 3D structure
  - binding constant
  - biological activity
  - qualitative binding

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

- 3H-thymidine
- 51 chromium
- any method
- binding assay
- bioassay
- biological activity
- BrdU
- cytometric bead array
- ELISA
- ELISPOT
- ICS
- in vitro assay
- in vivo assay
- in vivo skin test
- intracellular staining
- multimer/tetramer
- radio immuno assay (RIA)
- reporter gene assay
- RNA/DNA detection
- degranulation
- disease exacerbation
- dissociation constant KD
- G-CSF release
- GM-CSF release
- granulysin release
- granulysin release
- granzyme A release
- granzyme B release
- helper response
- IFN $\beta$  release
- IFN $\gamma$  release
- IL-10 release
- IL-12 release
- IL-13 release
- IL-15 release
- IL-16 release
- IL-17 release
- IL-17A release
- IL-17F release
- IL-18 release

# Allele Finder

**MHC Restriction** ?

Any MHC Restriction

MHC Class I

MHC Class II

MHC Nonclassical

Specific MHC Restrict... Ex: HLA-A\*02:01, H-2-Kb **Finder**

MHC restriction defined in assay

Alleles from 16 species

Search at level of:

- Species
- Class
- Serotype
- Allele

**ALLELE FINDER**

Current Selection(s) Reset Apply

**Search By**

Name: Ex: HLA-A\*02:01, H-2-Kb

Organism:

Class:

Clear Search

**Browse by Tree (Click to Select)**

- MHC
  - MHC molecule
  - serotype
  - mutant MHC molecule
  - haplotype

MHC class I

MHC class II

non-classical MHC

- bonobo (*Pan paniscus*)
- cattle (*Bos taurus*)
- chicken (*Gallus gallus*)
- chimpanzee (*Pan troglodytes*)
- cotton-top tamarin (*Saguinus oedipus*)
- dog (*Canis lupus familiaris*)
- gorilla (*Gorilla gorilla*)
- horse (*Equus caballus*)
- human (*Homo sapiens*)
- mouse (*Mus musculus*)
- organism (all species)
- pig (*Sus scrofa*)
- rat (*Rattus norvegicus*)
- rhesus macaque (*Macaca mulatta*)
- sheep (*Ovis aries*)

# Host Finder

Host ?

Any Host  
 Humans  
 Rodents  
 Non-human Primates  
 Specific Host

Ex: dog, camel

Finder

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

HOST ORGANISM FINDER

Current Selection(s) Reset Apply

**Search By**

Name: human  
Organism ID: 9606  
Clear Search

**Browse by Tree (Click to Select)**

- Vertebrate
  - Ave (bird)
  - Fish
  - Mammal
    - Equid (horse)
    - Glire (rodent or rabbit)
    - Camelid
    - Carnivore
    - Marsupial

**Search Results (Click to Select)**

1 Records Found Page 1 of 1 5 Per Page

Organism Name	Synonyms	Organism ID
Homo sapiens (human)	Homo sapiens, man, human	9606

1 Records Found Page 1 of 1 5 Per Page

Examples



# Disease Finder

**Disease ?**

Any Disease  
 Infectious Disease  
 Allergic Disease  
 Autoimmune Disease  
 Transplant Disease  
 No Disease (Healthy)  
 Specific Disease

Ex: asthma, diabetes

**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)

**DISEASE FINDER**

Current Selection(s) Reset Apply

**Search By**

Disease Name: asthma

Disease ID: Ex: 9415

ID Source: ▼

Clear Search

**Example**

**Browse by Tree (Click to Select)**

- host health status [DTREE\_00000185]
  - disease [DOID:4]
    - transplant-related disease and allo-reactivity [DTREE\_00000016]
      - allergy [DOID:1205]
        - infectious disease [DOID:0050117]
          - autoimmune disease [DOID:417]
            - additional diseases by category [DTREE\_00000013]
              - healthy [DTREE\_00000014]

**Search Results (Click to Select)**

2 Records Found Page 1 of 1 5 Per Page

Disease Name	Synonyms	Disease ID
allergic asthma [DOID:9415]	atopic asthma, extrinsic asthma with acute exacerbation, extrinsic asthma with status asthmaticus, Extrinsic asthma with status asthmaticus (disorder), atopic asthma, J45.0	DO [DOID:9415]
non-allergic/occupational asthma [DOID:2841]	bronchial hyperreactivity, Bronchial hypersensitivity, chronic obstructive asthma, chronic obstructive asthma with acute exacerbation, chronic obstructive asthma with status asthmaticus, Exercise indu ...more...	DO [DOID:2841]

2 Records Found Page 1 of 1 5 Per Page

# 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

The screenshot shows the IEDB search interface. At the top, there are navigation tabs: "Home", "Specialized Searches" (highlighted with a red box), and "Analysis Resource". Below the tabs is a "START YOUR SEARCH HERE" section with six search categories: Epitope, Antigen, MHC Restriction, Host, and Disease. Each category has a set of radio buttons and a text input field. The "Specialized Searches" dropdown menu is open, showing options: Epitope Details, T Cell Assay Details, B Cell Assay Details, MHC Assay Details, Identifier Search, and Browse by 3D Structure. The "Browse by 3D Structure" option is highlighted with a red box. At the bottom of the search area, there are "Reset" and "Search" buttons.

BASE  
CE

Home Specialized Searches Analysis Resource

START YOUR SEARCH HERE

**Epitope** ?

Any Epitopes  
 Linear Epitope  
Exact Mi:   
 Discontinuous Epitopes  
 Non-peptidic Epitopes

**Antigen** ?

Organism  
  
Antigen Name

**MHC Restriction** ?

Any MHC Restriction  
 MHC Class I  
 MHC Class II  
 MHC Nonclassical

**Host** ?

Any Host  
 Humans  
 Mice  
 Non-human Primates

**Disease** ?

Any Disease  
 Infectious Disease  
 Allergic Disease  
 Autoimmune Disease

Find Find Find Find Find

Reset Search

# 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



Structure Type - Any

Organism

Antigen Name

Epitope Referenc...

Epitope Related ...

Reference ?



Author

Title

Reference Details

Reference ID

Abstract

Affiliations

Date (Year)

Type - Any

Reset

Search

Pending Filters

Epitopes

Antigens

Assays

Go To Records Starting At 1200

GO

Page 1 of 17197

Details	Epitope	Antigen	Organism
123885	cardiolipin		
44920	NLVPMVATV	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)
113645	MEVGWYRSPFSRVVHLYRNGK	Myelin-oligodendrocyte glycoprotein	Mus musculus (mouse)
20354	GILGFVFTL	Matrix protein 1	Influenza A virus
58560	SIINFEKL	Gal d 2	Gallus gallus (chicken)
112741			
4802		protein	Influenza A virus
24786	HSLGKWLGHDPDF	Myelin proteolipid protein	Mus musculus (mouse)
130649	alpha-Gal epitope		
20788	GLCTLVAML	mRNA export factor ICP27 homolog	Human herpesvirus 4 (Epstein Barr virus)
112742	2,4,6-trinitrophenyl group		
130694	1-O-(alpha-D-galactosyl)-N-hexacosanoylphytosphingosine		
6435	CINGVCWTV	Genome polyprotein	Hepatitis C virus
48237	PKYVKQNTLKLAT	Hemagglutinin	Influenza A virus
32208	KLVALGINAV	Genome polyprotein	Hepatitis C virus
61086	SSIEFARL	Envelope glycoprotein B	Human herpesvirus 1 (Herpes simplex virus)
53112	RAHYNIVTF	Protein E7	Alphapapillomavirus 9
30001	KAVYNFATC	Pre-glycoprotein polyprotein GP complex	Lymphocytic choriomeningitis mammarenavirus
6568	CLGGLLTMV	Latent membrane protein 2	Human herpesvirus 4 (Epstein Barr virus)
7493		Amyloid beta A4 protein	Homo sapiens (human)

Epitope fields

Reference fields

Reset Search

Epitopes (543637)

Antigens (35440)

Assays (11867)

**Epitope** ?

Epitope ID

Structure Type - Any Epitopes

Organism

Antigen Name

**Epitope Reference Details**

Epitope Structure Defines

Evidence Code for Source...

Epitope Name

Reference Start Position  to

Reference End Position  to

Reference Region

Comments

Data Location in Reference

**Epitope Related Object**

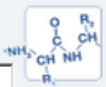
Related Object

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



Go To Records Starting At

Page  of 21746

Antigen	Organism
65 kDa phosphoprotein	Human h
Matrix protein 1	Influenza
Myelin-oligodendrocyte glycoprotein	Mus mus
Gal d 2	Gallus ga
->4)-D-GlcpNAc-yl group	Influenza
Genome polyprotein	Hepatitis
Hemagglutinin	Influenza
Genome polyprotein	Hepatitis
Other Human papillomavirus protein	Human p
Nucleoprotein	Influenza
Amyloid beta A4 protein	Homo sa
Polymerase acidic protein	Influenza
Nucleoprotein	Lymphoc

**Search by epitope name, start/stop positions, etc.**

**Search for analogs or mimotopes**

**Reference** ?

Author

Title

7493	DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGWIA
61151	SSLENFRAYV
17516	FQPQNGQFI


# 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	MEVGVYRSPPFSRVVHLYRNGK	+	Myelin-oligodendrocyte glycoprotein	+	Mus mu...
20354	GILGFVFTL	+	Matrix protein 1	+	Influenza
58560	SIINFEKL	+	Gal d 2	+	Gallus g
112741	2,4-dinitrophenyl group	+			
4602	ASNENMETM	+	Nucleoprotein	+	Influenza
24786	HSLGKWLGHDPKF	+	Myelin proteolipid protein	+	Mus mu...
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

Reference ?

Author

Title

Reference ID

Abstract

Affiliations

Date (Year)  to

Type - Any

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

**Search by author(s), journal, etc.**

Reset Search

429919 Records Found

Page 1 of 17197

Go To Records Starting At 1200

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

- Epitope Related ...
- Epitope Related ...
- Host** ?
- Host Organism
- Host Details
- 1st In Vivo Process
- 1st Immunogen
- 2nd In Vivo Process
- 2nd Immunogen
- In Vitro Administr...
- In Vitro Immunogen
- Immunization Co...
- 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** ?

58560	SIINFEKL	Gal d 2	Gallus gallus (chicken)
4602	ASNENMETM	Nucleoprotein	Influenza A virus
24786			
11274			
13069			
6435			
20788			
32208			
53112			
61086			
11274			
6568			
61151			
3000			
67436	TYQRTRALV	Nucleoprotein	Influenza A virus
65748			
16878			
17516			
37257			
68846			
16833			
23376			
1038			

**How did host acquire immune reactivity?  
Immunized, naturally infected, etc.**

**Specify immunogen (epitope, protein, organism,  
etc.)**

**Search by specific host disease**

**Search by specific assay type**

**Specify effector cells, mAb name, or antibody  
isotype(s)**

**Specify assay antigen (epitope, protein, organism,  
etc.)**



# Assay Details – In Vivo Processes

Structure Type - Any f	Details	Epitope	Antigen	Organism
Organism	44920	NLVPMVATV	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)
Antigen Name	113645	MEVGWYRSPFSRWVHLYRNGK	Myelin-oligodendrocyte glycoprotein	Mus musculus (mouse)
Epitope Referenc...	20354	GILGFVFTL		
Epitope Related ...	58560	SIINFEKL		
	4602	ASNENMETM		
	24786			

**Host** ?

Host Organism

- Host Details
- 1st In Vivo Process**
- 1st Immunogen
- 2nd In Vivo Process**
- 2nd Immunogen
- In Vitro Administration
- In Vitro Immunogen
- Immunization Comments
- Adoptive Transfer

67436	TYQRTRALV
16878	FLRGRAYGL
17516	FQPQNGQFI
16833	FLPSDFFPSV
37257	LLFGYPVYV
68846	VHFFKNIVTPRTP
23376	GYKDGNEYI

109298 Records Found

**Assay** ?

Qualitative Measurement

Assay

- Measurement Det...
- Effector Cells
- Assayed TCR Mol...
- Antigen Presentin...
- MHC Allele
- Antigen
- 3D Structure of C...
- Assay Reference ...

**Reference** ?

Address

**Describes how the host acquired immune reactivity.**

# Assay Details – In Vivo Process Types

20354	GILGFVFTL
58560	SIINFEKL
4602	ASNENMETM
21786	UNUSUAL SUBTYPE

Matrix protein 1

Host ?

Host Organism: Ex: dog, camel [Finder]

Host Details

1st In Vivo Process

Present in Search Results: May or may not be present

**In Vivo Process Type**

Disease State

Disease Stage

Administration Details

1st Immunogen

2nd In Vivo Process

2nd Immunogen

In Vitro Administration

In Vitro Immunogen

Immunization Comments

Adoptive Transfer

23376	GYKDGNEYI
-------	-----------

Assay ?



**“Administration group”**



**“Occurrence group”**



**“Exposure group”**

**Others:**

- **Transplant/transfusion**
- **No immunization**
- **Unknown**

**All process types are defined in the Curation Manual**



# Identifier Search

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

Home Specialized Searches Analysis Resource

Positive Assays Only

Epitopes

(9852)

d

pin

V

PFSRVVHLYRNGK

L

trophenyl group

M

HPDKF

l epitope

nitrophenyl group

L

ha-D-galactosyl)-  
sanoylphytosphingosine

V Genome polyprotein

**IDENTIFIER SEARCH** X

**IEDB Identifiers**

Epitope ID Ex: 44920

Reference ID Ex: 315120

Submission ID Ex: 1000548

Assay ID Ex: 1710106

**External Identifiers**

PubMed ID Ex: 24196962

PDB ID Ex: 4NM8

ChEBI ID Ex: CHEBI:28494

Search

Unique identifiers created by IEDB

Unique identifiers from other resources

# Identifier Search

**IDENTIFIER SEARCH** [X]

**IEDB Identifiers**

Epitope ID

Reference ID

Submission ID


Assay ID

**External Identifiers**

PubMed ID

PDB ID

ChEBI ID



**Pending Filters**

**Epitope** ?

Any Epitopes

Linear Epitope

Discontinuous Epitopes

Non-peptidic Epitopes

3D structure available

Amino Acid Modification

**Antigen** ?

Organism

Antigen Name

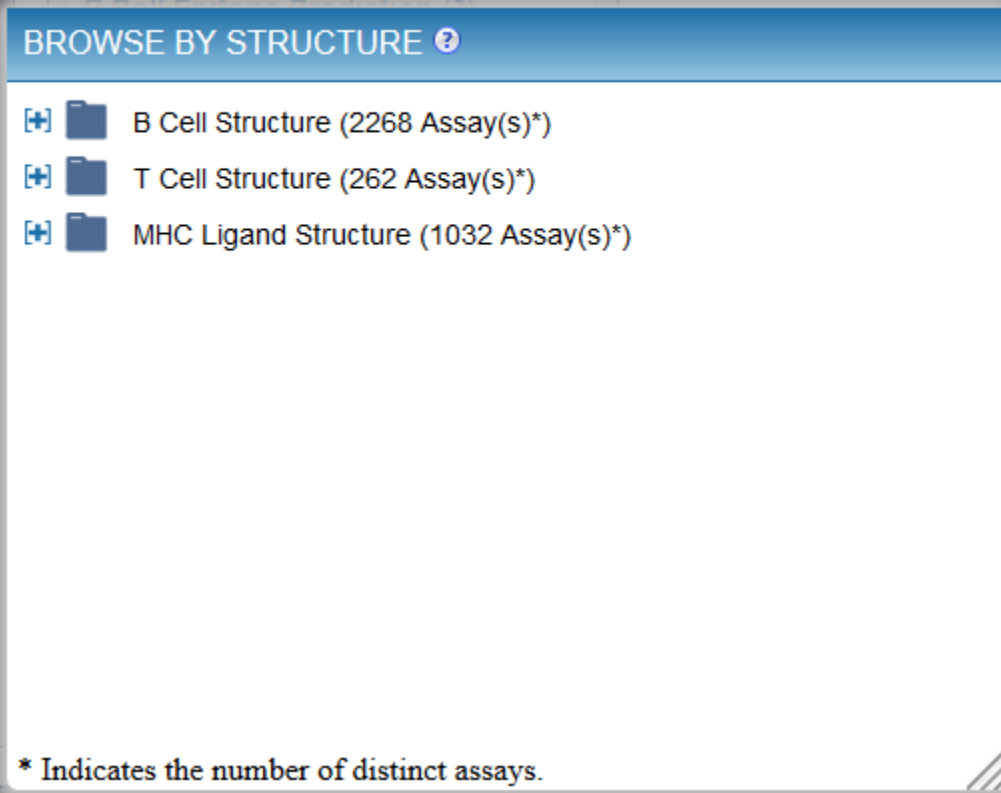
**Receptor** ?

**Current Filters:**  Reference Type: Journal Article  PubMed Id: 22311355

Epitopes (9)		Antigens (1)		Assays (17)		Receptors (0)	
9 Records Found							
Go To Records Starting At <input type="text" value="1200"/> <input type="button" value="GO"/>							
Page 1 of 1							
Details	Epitope	Antigen	Organism				
3078	AMDSNTLEL	Nucleoprotein	Influenza A virus				
6615	CLPACVYGL	Nucleoprotein	Influenza A virus				
21255	GMDPRMCSL	Nucleoprotein	Influenza A virus				
32157	KLSDYEGRL	Nucleoprotein	Influenza A virus				
36516	LIFLARSAL	Nucleoprotein	Influenza A virus				
42974	MVMELIRMI	Nucleoprotein	Influenza A virus				
54592	RLIQNSITI	Nucleoprotein	Influenza A virus				
144292	FQGRGVFEL	Nucleoprotein	Influenza A virus				
164335	QLSTRGVQI	Nucleoprotein	Influenza A virus				
9 Records Found							
Page 1 of 1							
Go To Records Starting At <input type="text" value="1200"/> <input type="button" value="GO"/>							

# Browse by 3D Structure

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



BROWSE BY STRUCTURE ?

- [-] B Cell Structure (2268 Assay(s)\*)
- [-] T Cell Structure (262 Assay(s)\*)
- [-] MHC Ligand Structure (1032 Assay(s)\*)

\* Indicates the number of distinct assays.

# Browse by 3D Structure

## BROWSE BY STRUCTURE ?

- [+] B Cell Structure (2268 Assay(s)\*)
- [+] T Cell Structure (262 Assay(s)\*)
  - [+] MHC molecule (253 Assay(s)\*)
    - [+] class I (118 Assay(s)\*)
      - [+] human (101 Assay(s)\*)
        - [+] HLA-A (72 Assay(s)\*)
          - HLA-A\*01:01 (2 Assay(s)\*)
          - HLA-A\*02:01 (62 Assay(s)\*)
          - HLA-A\*11:01 (2 Assay(s)\*)
          - HLA-A\*24:02 (6 Assay(s)\*)
        - [+] HLA-B (29 Assay(s)\*)
      - [+] mouse (17 Assav(s)\*)

\* Indicates the number of distinct assays.

# 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

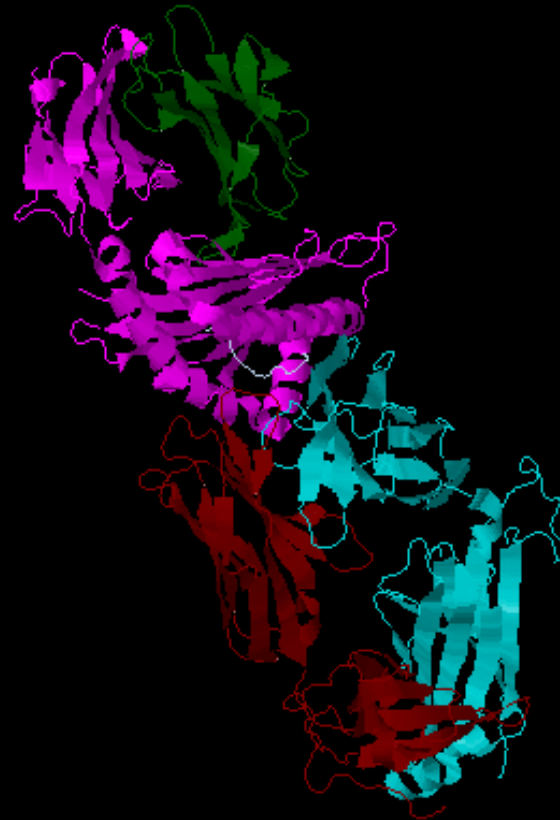
Page 1 of 3

62 Records Found

ID	Reference	Epitope	Host	Immunization	Assay Antigen	Antigen Epitope Relation	MHC Rest
2119223	Oleg Y Borbulevych; 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/ubiquitous 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



Epitope to MHC

- G1
- I2
- L3
- G4
- F5
- V6
- F7
- T8
- L9

Epitope to TCR

MHC to Epitope

TCR to Epitope

JSmol

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

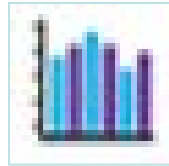
TCR to Epitope

JSmol

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?**

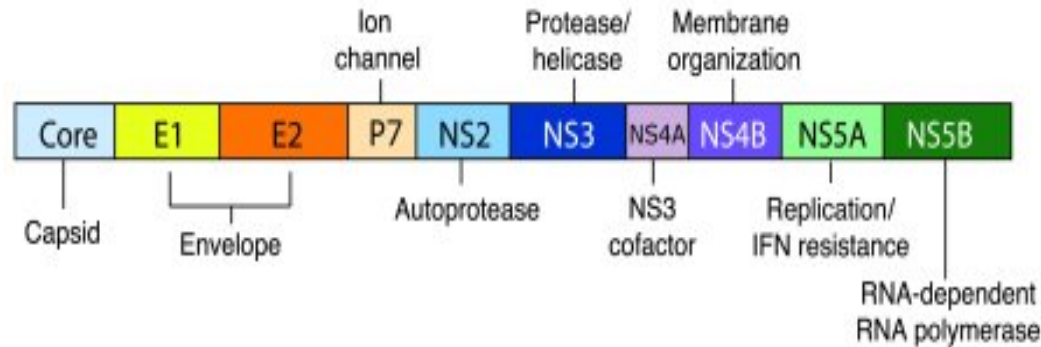
IB icon found on the Antigen Tab of Results page

- **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

**START YOUR SEARCH HERE**

**Epitope**

Any Epitopes  
 Linear Epitope  
 Ex: SIINFEKL    Exact Matches  
 Discontinuous Epitopes  
 Non-peptidic Epitopes

**Assay**

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

**Antigen**

Organism  
 HCV  
 Hepatitis C virus (ID:11103, HCV)  
 Hepatitis C virus (isolate H) (ID:11108, HCV-H)  
 Classical swine fever virus (ID:11096, hog cholera virus HCV)  
 Hepatitis C virus HCV-KF (ID:31644)  
 Hepatitis C virus genotype 1 (ID:41856, hepatitis C virus 1 HCV 1)  
 Hepatitis C virus subtype 1b (ID:31647, hepatitis C virus type 1b H...  
 Rodents  
 Non-human Primates  
 Other Common Hosts

**MHC Restriction**

Any MHC Restriction  
 MHC Class I  
 Allergic Disease  
 Autoimmune Disease  
 Transplant Disease

Reset    **Search**

<b>Epitopes</b> (4645)	<b>Antigens</b> (3)	<b>Assays</b> (13713)	<b>Receptors</b> (162)	<b>References</b> (598)
---------------------------	------------------------	--------------------------	---------------------------	----------------------------

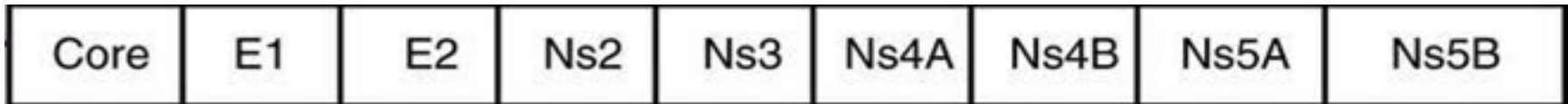
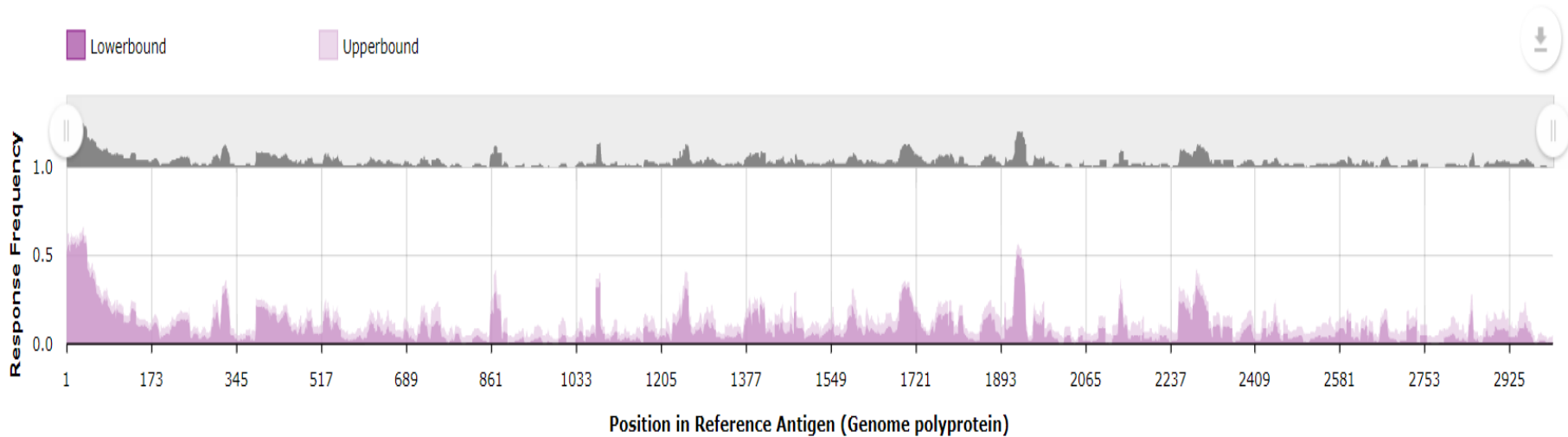
Go To Records Starting At 1200 **GO**    Export Re

3 Records Found    Page 1 of 1    25

Antigen	Organism	# Epitopes	# Assays	# Referen
Genome polyprotein	 Hepatitis C virus	4610	13582	596
Other Hepatitis C virus protein	 Hepatitis C virus	20	82	13

# Response Frequency Graph

Response Frequency [?](#)



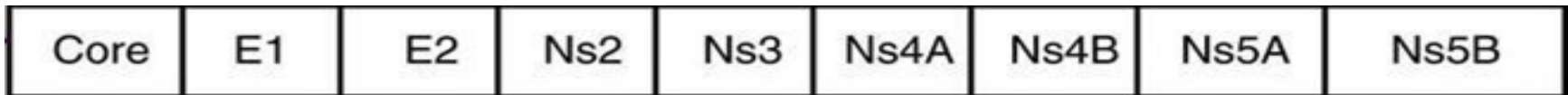
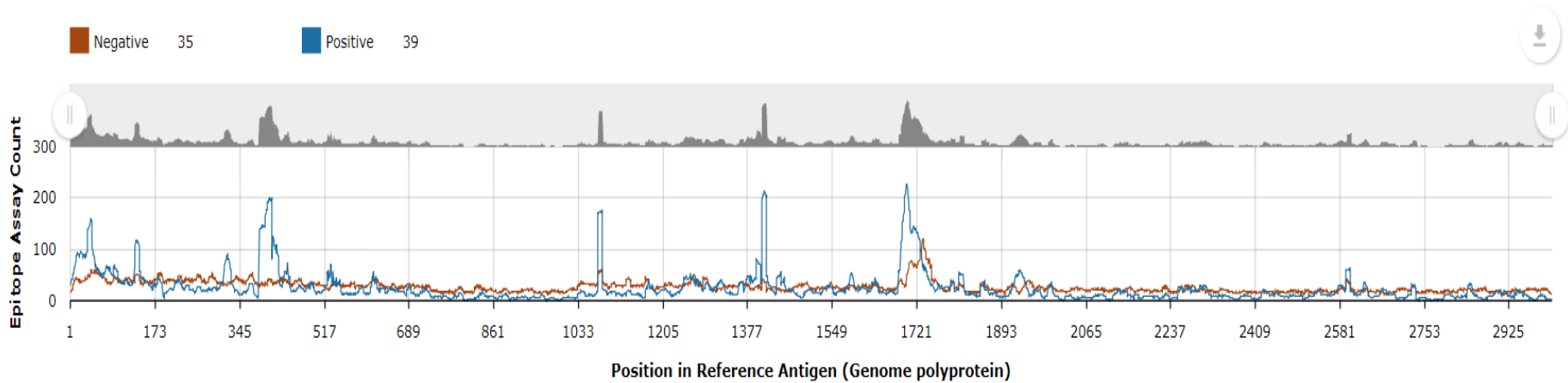
**Top graph:**

Y-axis = RFscore

X-axis = epitope residue position

# Assay Counts Graph

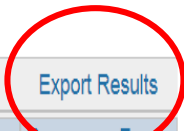
Epitope Assay Counts [?](#)



**Bottom graph:**  
Positive and Negative assay count



# IB Data Table



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

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	MSTNPKPQRKTKRNTNRRPQDVKFPGGGQIVGGVYLLPRRGPR	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	MSTNPKPQRKTKRNTNRRPQDVKFPFG	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	MSTIPKPKRKTNRN	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	MSTLKPQRKTKRNTIRRQ	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]

[Home](#) [Help](#) [Example](#) [Reference](#) [Contact](#)

## ImmunomeBrowser

step 1/3 Specify input data

### Specify Epitope Data

Enter epitope data in specified format

MALWMRLLPLLALLAL	33	2		
MALWMRLLPLLALLALWGPDPAAA		1	1	
ALWMRLLPL	54	19		
ALWMRLLPLL	50	12		
WMRLLPLLAL	7	3		
RLLPLLALL	72	19		
LLPLLALLALWGPDPAA	33	2		
PLLALLALWG	6	4		
LALLALWGPDPAAAFV	1	1		
LALWGPDPAAAFVNQHLCGS	1	1		

Or upload epitope data from a file  No file chosen

Please select a format for epitope data

Please check to autofill missing epitope response data

### Specify source antigen sequence/s

Paste source protein sequence in Fasta or plain format

```
>seq_P01308.1
MALWMRLLPLLALLALWGPDPAAAFVNQHLCGSHLVEALYLVCGERGFFYTPKTRREAEDLQVGGQVEL
GGGPGAGSLQPLALEGSLQKRGIVEQCCTSIKSLYQLENYCN
>seq_NP_000198.1
MALWMRLLPLLALLALWGPDPAAAFVNQHLCGSHLVEALYLVCGERGFFYTPKTRREAEDLQVGGQVEL
```

Or upload source antigen sequence(s) from a file  No file chosen

### Specify identity threshold for epitope mapping

Please select identity threshold for epitope mapping

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
  - ***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)
  - **‘Coverage’ and/or Immunoprominence**
    - Immunome Browser
- Specialized Search - Process type**
- Assay specific Query**
- Results Page Antigen Tab**

# Example Queries

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

**START YOUR SEARCH HERE ?**

**Epitope ?**

Any Epitopes

Linear Epitope

Exact M

Discontinuous Epitopes

Non-peptidic Epitopes

**Assay ?**

Positive Assays Only

T Cell Assays

B Cell Assays

MHC Ligand Assays

Ex: neutralization

**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

**Host ?**

Any Host

Humans

Mice

Non-human Primates

Ex: dog, camel

**Disease ?**

Any Disease

Infectious Disease

Allergic Disease

Autoimmune Disease

Ex: asthma, diabete

## 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									
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									
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

Epitopes (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

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	ASNMETM nucleoprotein (366-374) Influenza A virus	Mus musculus C57BL/6	Primary induction in vitro with ASNMETM (Epitope)	NLDNLRDYL large T antigen (493-501) Macaca mulatta polyomavirus 1	Other	H2-b class I	51 chromium cytotoxicity Positive-Low
191919	J A Speir; Immunity 1999	ASNMETM + GLYC(E4) Nucleoprotein (366-374) Influenza A virus (A/Puerto Rico/8/1934(H1N1))	Mus musculus C57BL/6	Administration in vivo with ASNMETM + GLYC(E4) (Epitope) followed by restimulation in vitro	ASNMETM + 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	ASNMETM 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	ASNMETM 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	ASNMETM + GLYC(M6) Nucleoprotein (366-374) Influenza A virus (A/Puerto Rico/8/1934(H1N1))	Mus musculus C57BL/6	Administration in vivo with ASNMETM + GLYC(M6) (Epitope) followed by restimulation in vitro	ASNMETM + 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	ASNMETM Nucleoprotein (366-374) Influenza A virus	Mus musculus C57BL/6	Administration in vivo with Influenza A virus (Source Organism) followed by restimulation in vitro	ASNMETM 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	ASNMETM Nucleoprotein (366-374) Influenza A virus	Mus musculus C57BL/6	Administration in vivo with Influenza A virus (A/X-31(H3N2)) (Taxonomic Child)	ASNMETM Nucleoprotein (366-374) Influenza A virus	Epitope	H2-Db	51 chromium cytotoxicity Positive
1266964	M B Oldstone; Virology 1999	ASNMETM nucleoprotein (366-374) Influenza A virus	Mus musculus	Administration in vivo with Influenza A virus (Source Organism) followed by restimulation in vitro	ASNMETM 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 <input type="button" value="GO"/>									
145 Records Found <input type="button" value="Previous"/> Page 1 of 6 <input type="button" value="Next"/>									
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				
10329	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

5 Records Found

Details	Epitope	
4602	ASNENMETM	
4600	ASNENMETM + MCM(E7)	
4601	ASNENMETM + MCM(M6)	
161084	ASNENMETM + GLYC(E4)	
161085	ASNENMETM + GLYC(M6)	



Click on 'funnel' to select an epitope of interest



Epitopes (1)    Antigens (1)    Assays (397)    Receptors (190)    References (643)

Go To Records Starting At 1200  [Export Results](#)

1 Records Found    Page 1 of 1    25 Per Page

Details	Epitope	Antigen	Organism	# References	# Assays
4602	ASNENMETM	 Nucleoprotein	 Influenza A virus	 144	397

1 Records Found    Page 1 of 1    25 Per Page

Tabs will re-set data for only that epitope

# Looking for homologous peptides

Update Filters

Pending Filters: ✗ Linear Sequence: ASNENMETM ✗ Positive Assays Only ✗ Epitope Structure: Linear Sequence

Reset **Search**

**Epitopes** (5)

**Antigens** (1)

**Epitope** ?

Any Epitopes

Linear Epitope

Discontinuous Epitopes

Non-peptidic Epitopes

ASNNENMETM

Ex: penicillin

Exact Matches: ▾

- Exact Matches
- Substring
- Blast - 90%
- Blast - 80%
- Blast - 70%

Go To Records Starting At | Ex:

Page 1 of 1

**Antigen**

- Nucleoprotein
- Nucleoprotein
- Nucleoprotein

161084	ASNENMETM + GLYC (E4)	Nucleoprotein
161085	ASNENMETM + GLYC (M6)	Nucleoprotein

5 Records Found

Page 1 of 1

Go To Records Starting At | Ex:

**Antigen** ?

Organism

Ex: influenza, peanut

Antigen Name

Ex: core, capsid, myosin


**Assay** ?

Positive Assay Only

T Cell Assays

B Cell Assays

MHC Ligand Assays



# 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 <input type="button" value="GO"/>					
176 Records Found <input type="button" value="Previous"/> <input type="button" value="Page 1 of 8"/> <input type="button" value="Next"/>					
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	AAENMETM				
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 <input type="text" value="Ex: A.b"/> <input type="button" value="GO"/>									
Export T Cell Assays Results <input type="button" value="X"/>									
2 Records Found <input type="button" value="&lt;&lt;"/> <input type="button" value="Page"/> 1 of 1 <input type="button" value="&gt;&gt;"/> 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 <input type="button" value="&lt;&lt;"/> <input type="button" value="Page"/> 1 of 1 <input type="button" value="&gt;&gt;"/> 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	
<b>Reference</b>	
<b>Article Authors:</b>	R A Uger; S M Chan; B H Barber
<b>Article Title:</b>	Covalent linkage to beta2-microglobulin enhances the MHC stability and antigenicity of suboptimal CTL epitopes.
<b>Reference Detail</b>	
<b>Reference ID:</b>	<a href="#">1000159</a>
<b>Abstract:</b>	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.
<b>Affiliations:</b>	Department of Immunology, Medical Sciences Building, University of Toronto, Toronto, Canada.
<b>Date:</b>	1999
<b>Reference Type:</b>	Literature
<b>PubMed ID:</b>	<a href="#">10229842</a>
<b>Journal:</b>	J Immunol
<b>Journal Volume:</b>	162
<b>Article Pages:</b>	6024-8
<b>Journal ISSN:</b>	0022-1767
<b>Article Chemical List:</b>	Antigens, Viral;Epitopes;Nucleoproteins;Recombinant Fusion Proteins;Vaccines, Synthetic;Viral Core Proteins;beta 2-Microglobulin
<b>Article MeSH List:</b>	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	
<b>Epitope</b>	
<b>Epitope ID:</b>	<a href="#">733</a>
<b>Chemical Type:</b>	Linear peptide
<b>Linear Sequence:</b>	ADNENMETM
<b>Epitope Reference Details</b>	
<b>Epitope Structure Defines:</b>	Exact Epitope
<b>Epitope Name:</b>	D2
<b>Epitope Related Object</b>	
<b>Related Object Type:</b>	The epitope is an analog of:
<b>Chemical Type:</b>	Linear peptide
<b>Linear Sequence:</b>	ASNENMETM
<b>Starting Position:</b>	366
<b>Ending Position:</b>	374
<b>Source Molecule Name:</b>	Nucleoprotein
<b>Source Accession:</b>	SRC124
<b>Source Organism ID:</b>	<a href="#">11320</a>
<b>Source Organism:</b>	Influenza A virus

**T Cell Assay Information**

<b>Immunization</b>	
<b>Host Organism ID:</b>	1000067
<b>Host Organism:</b>	Mus musculus C57BL/6
<b>1st In Vivo Process</b>	
<b>In Vivo Process Type:</b>	Administration in vivo
<b>Administration Details</b>	
<b>Dose Schedule:</b>	1
<b>1st Immunogen</b>	
<b>Epitope Relation:</b>	Structurally Related
<b>Object Type:</b>	Organism
<b>Organism ID:</b>	11320
<b>Organism:</b>	Influenza A virus
<b>Immunogen Details</b>	
<b>Immunogen Evidence Code:</b>	Representative selection
<b>Immunogen Reference Name:</b>	Influenza A virus
<b>In Vitro Administration</b>	
<b>In Vitro Process Type:</b>	Restimulation in vitro
<b>Responder Cell Type:</b>	Splenocyte
<b>Stimulator Cell Type:</b>	Splenocyte

<b>In Vitro Immunogen</b>	
<b>Epitope Relation:</b>	Epitope
<b>Chemical Type:</b>	Linear peptide
<b>Linear Sequence:</b>	ADNENMETM
<b>Immunogen Details</b>	
<b>Immunogen Evidence Code:</b>	Exact match to reference
<b>Immunization Comments</b>	
<b>Immunization Comments:</b>	The route of immunization and CTL generation with 1 $\mu$ M NP 366-374 peptide
<b>T Cell Assay</b>	
<b>Qualitative Measurement:</b>	Positive
<b>Method/Technique:</b>	51 chromium release
<b>Measurement of:</b>	cytotoxicity

<b>Effector Cells</b>	
<b>Effector Cell Tissue Type:</b>	Spleen
<b>Effector Cell Type:</b>	Splenocyte
<b>Effector Cell Culture Conditions:</b>	Short Term Restimulated
<b>Antigen Presenting Cells</b>	
<b>Cell Tissue Type:</b>	Lymphoid
<b>Cell Type:</b>	EL-4 cells-Lymphoblast
<b>Cell Culture Conditions:</b>	Cell Line / Clone
<b>Autologous or Syngeneic:</b>	Y
<b>MHC Allele</b>	
<b>MHC Allele Name:</b>	H-2-Db
<b>MHC Evidence Code:</b>	Cited reference
<b>Antigen</b>	
<b>Epitope Relation:</b>	Epitope
<b>Chemical Type:</b>	Linear peptide
<b>Linear Sequence:</b>	ADNENMETM
<b>Antigen Details</b>	
<b>Antigen Evidence Code:</b>	Exact match to reference information
<b>Antigen Reference Name:</b>	D2-h $\beta$ 2m
<b>Antigen Containing Object</b>	
<b>Complex Type:</b>	Protein conjugate
<b>Molecule Name:</b>	Beta-2-microglobulin precursor
<b>Molecule Accession:</b>	<a href="#">48428791</a>
<b>Molecule Source Organism ID:</b>	9606
<b>Molecule Source Organism:</b>	Homo sapiens
<b>Assay Reference Details</b>	
<b>Assay Comments:</b>	CTL specific for NP 366-374 were co-cultured with EL4 target cells loaded with either 1) D2 peptide plus soluble human $\beta$ 2-microglobulin or 2) a fusion protein comprised of the D2 peptide covalently linked to human $\beta$ 2-microglobulin (D2-h $\beta$ 2m). 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-h $\beta$ 2m fusion protein induced a higher level of specific lysis than the free peptide at lower peptide/protein concentrations.
<b>Location of Assay Data in Reference:</b>	Figure 4A

# Example B Cell Details Search

Find Ebola virus epitopes recognized by neutralizing human monoclonal antibodies.



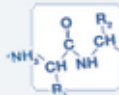
## START YOUR SEARCH HERE ?

## Epitope ?

- Any Epitopes  
 Linear Epitope

Exact Match:

- Discontinuous Epitopes  
 Non-peptidic Epitopes



## Antigen ?

Organism

Antigen Name



## Host ?

- Any Host  
 Humans  
 Mice  
 Non-human Primates



## MHC Restriction ?

- Any MHC Restriction  
 MHC Class I  
 MHC Class II  
 MHC Nonclassical



## Disease ?

- Any Disease  
 Infectious Disease  
 Allergic Disease  
 Autoimmune Disease



- Epitope Details
- T Cell Assay Details
- B Cell Assay Details
- MHC Assay Details
- Identifier Search
- Browse by 3D Structure

- B Cell Assays  
 MHC Ligand Assays



Reset

Search

1. Select "B Cell Assay Details"

patterns indicative of:

- 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

B Cell Detailed Search

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

Reset

Search

Epitopes

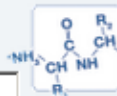
(319526)

Antigens

(4118)

Epitope ?

Epitope ID



Structure Type - Any Epitopes

Organism

Finder

Antigen Name

Finder

Epitope Reference Details

Epitope Related Object

**2. Select epitope organism**

Host ?



Host Organism

Host Details

1st In Vivo Process

1st Immunogen

2nd In Vivo Process

2nd Immunogen

Immunization Com...

Adoptive Transfer

Assay ?



Epitope ID	Epitope	Antigen
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	



- Immunization Com...
- Adoptive Transfer

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	

### Assay ?

- Qualitative Measurement
- Assay
- Measurement Details
- Assayed Antibody
- Antigen
- 3D Structure of Complex
- Assay Reference Details

Positive

Select All Unselect All

- Positive
- Positive-Low
- Positive-Intermediate
- Positive-High
- Negative



**4. Filter for positive responses only**

### Reference ?



- Author
- Title
- Reference Details
- Reference ID
- Abstract
- Affiliations
- Date (Year)

Type - Any

Reset Search

139650	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

### Assay ?

Qualitative Measurement

Positive

Assay

neutralization | biological act

Finder

Measurement Details

Assayed Antibody

Antigen

3D Structure of Complex

Assay Reference Details

### Reference ?

Author

Title

Reference Details

Reference ID

Abstract

Affiliations

Date (Year)

Type - Any

Reset

Search

115009

phosphocholine

135393

phosphatidylcholine(1+)

138830

beta-D-Gal(1->3)-beta-D-GalNAc(1->4)-beta-D-Gal(1->4)-beta-D-Glc

5. Select assay type

139630

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

135396

phosphatidic acid

59318

SLLTEVETPIRNEWGCRCNDSSD

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

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

- Monoclonal
- Polyclonal
- Polyclonal-Monospecific
- Display Library
- Display Library (monoclonal)

Antigen

3D Structure of Complex

Assay Reference Details

c-(1->4)-beta-D-Gal-(1->4)-beta-D-Glc-	+	
5Ac-(2->3)-beta-Gal-(1->3)-beta-GalNac-ha-Neu5Ac-(2->3)]-beta-Gal-(1->4)-beta-	+	
>3)-beta-D-galactosyl-(1->3)-N-acetyl-alpha-N-acetylneuraminosyl-(2->3)]-beta-oyl-(1<->1')-N-acylsphingosine	+	
DVGSNKGAIIGLMVGGWV	+	Amyloid beta A4 protein
D	+	Matrix protein 2

**6. Select antibody purification status = "Monoclonal"**

### Reference ?

Author

Title

Reference Details

Reference ID

Abstract

Current Filters: ✖ Epitope Organisms: Ebolavirus (ID:186536) ✖ Host Organism: Homo sapiens (human) (ID:9606, Homo sapien) ✖ 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

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

15 Records Found

Page 1 of 1

25 Per Page

Go To Records Starting At 1200

Export Results

Current Filters: ✖ Epitope Organisms: Ebolavirus (ID:186536) ✖ Host Organism: Homo sapiens (human) (ID:9606, Homo sapien) ✖ 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  [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  [Export Results](#)



Current Filters: **X** Epitope Organisms: Ebolavirus (ID:186536) **X** Host Organism: Homo sapiens (human) (ID:9606, Homo sapien) **X** assay-qualitative\_measurement: Positive **X** assay-assay\_b\_cell\_data: neutralization |biological activity (neutralization)

**X** 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

[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 <b>Positive-Intermediate</b>
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 <b>Positive-Intermediate</b>
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 <b>Positive</b>
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 <b>Positive</b>
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 <b>Positive</b>
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 <b>Positive</b>
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 <b>Positive</b>
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 <b>Positive</b>
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 <b>Positive</b>
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 <b>Positive</b>

# 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<sup>+</sup> T cells and defined in humans.

# Live Demo (NS) - T Cell Details Search

✓ Find *Plasmodium falciparum* T cell epitopes tested specifically on CD8<sup>+</sup> T cells and defined in humans.

➔ Have tetramers been made with any of these epitopes and used to detect CD8<sup>+</sup> 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