

IEDB Overview

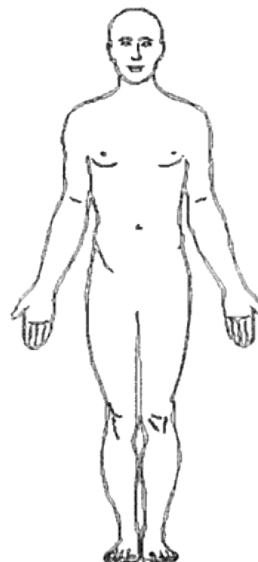
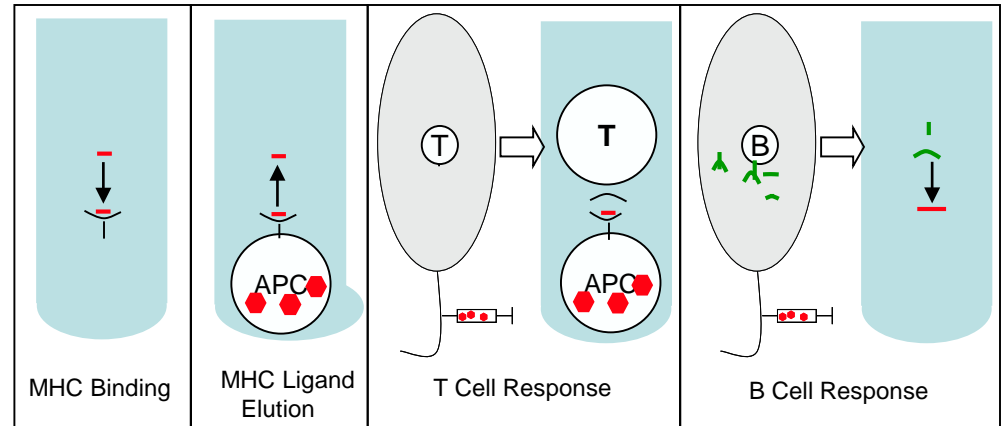
Bjoern Peters, Ph.D.

Professor

IEDB Co-Principal Investigator

The Immune Epitope Database

- Free online resource of experimentally-derived epitope information
 - Allergens
 - Infectious diseases
 - Autoimmune diseases
 - Transplant/alloantigens
- Over 19,500 curated articles + direct submissions
 - 522,250 unique epitopes
 - Almost 1.9 million assays



An Assay-centric, Context Dependent View

- Scientists have different definitions for epitopes
- IEDB captures the actual experimental assays in which epitopes were determined and characterized
- Users can search for epitopes based on these characteristics

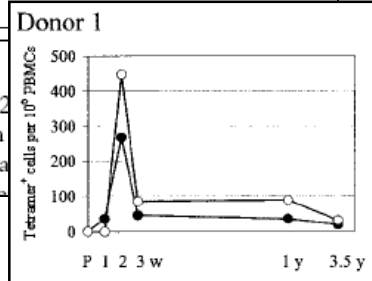
Consistent Data Entry Requires Well Defined Data Structure

Quantitation of CD8⁺ T Cell Responses to Newly Identified HLA-A*0201-restricted T Cell Epitopes Conserved Among Vaccinia and Variola (Smallpox) Viruses

Masanori Terajima, John Cruz, Gregory Raines, Elizabeth D. Kilpatrick, Jeffrey S. Kennedy, Alan L. Rothman, and Francis A. Ennis

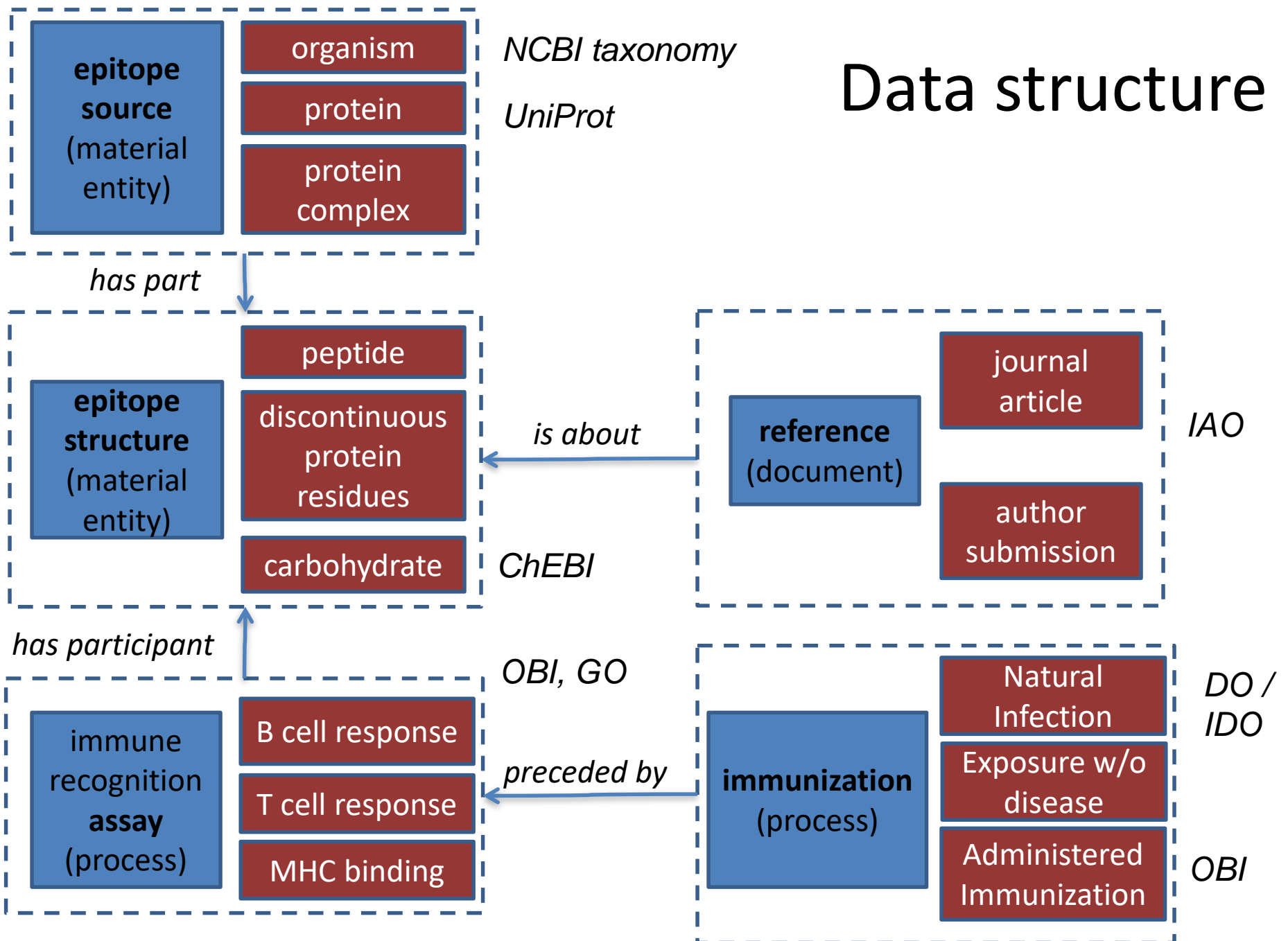
Materials and Methods

Donors. Donors in this study were three HLA-A*0201-positive laboratory workers received primary immunization with the licensed smallpox vaccine, *Imvax*®, manufactured by the Centers for Disease Control and Prevention.

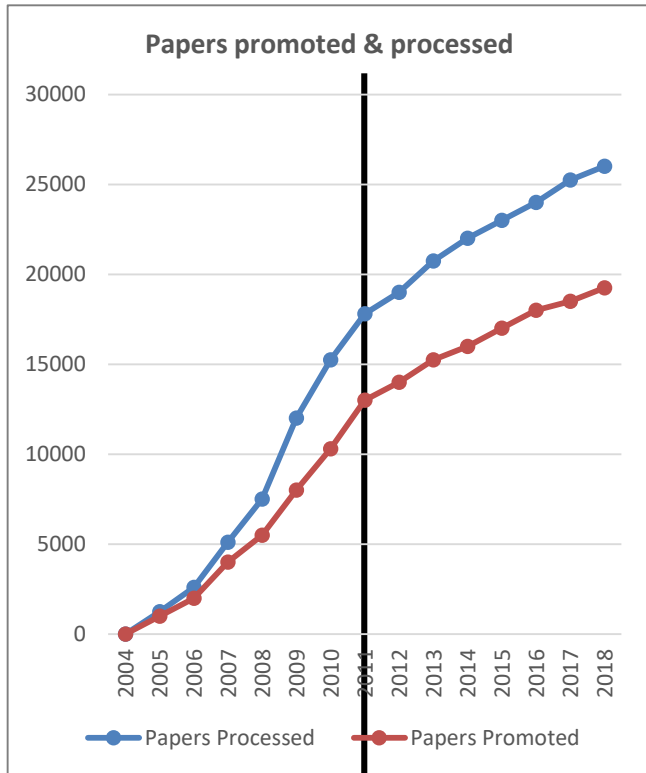


Epitope	Structure	Name	74A
		Chemical Type	Peptide/Protein
		Sequence	CLTEYILWV
		Domain / Region	Defined Epitope
Epitope	Source	Species	Vaccinia virus Ankara
		Strain	Ankara (MVA)
		Antigen	putative 21.7k protein
		Antigen Accession	2772819
		Antigen Positions	79-87
Context	Immunization	Immunized Species	Homo sapiens
		Immunogen Type	Source Species
		Administration	Scarification
	Assay	Antigen Type	Epitope
		Assay Type	ELISPOT
		Response Measured	Cytokine Release-IFN-g
		MHC Allele	HLA-A*0201

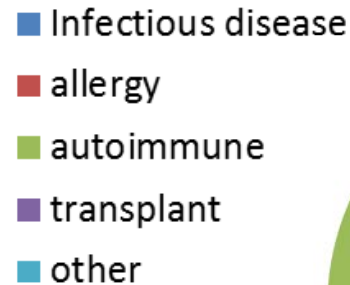
Data structure



Metrics: Content



Completion of
historic curation



- 1,900,000 assays
- 522,250 epitopes
- 19,500 papers
- 330 data submissions

Latest home page & search interface



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

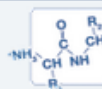
22-23 October 2018
LJI, San Diego, CA, USA
Information available at
workshop.iedb.org.

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
Exact Mz ▾ 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, diabetes

Reset

Search

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](#)

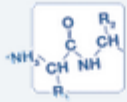
Epitope Analysis Tools ?

Analyze epitope sets of:


- [Population Coverage](#)
- [Conservation Across Antigens](#)
- [Clusters with Similar Sequences](#)

Example Query: T cell epitopes recognized in Timothy grass allergic humans


START YOUR SEARCH HERE ?

Epitope ? 


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

Assay ? 


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

Antigen ? 


Organism
 ¹
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, diabet

Ontologies enable aggregation of results

Current Filters: Positive Assays Only Organism: Phleum pratense (timothy grass) (ID:15957, timothy) No B cell assays No MHC ligand assays

Host: Homo sapiens (human) Disease Data: Allergic Disease

Epitopes

(600)

Antigens

(9)

Assays

(1259)

Receptors

(0)

References

(18)

Go To Records Starting At

Export Results

600 Records Found

Page of 24

Per Page

Details	Epitope	Antigen	Organism	# References	# Assays
38854	LQIIDKIDAAFVAA	Phl p 5	Phleum pratense (timothy grass)	4	6
125665	AFKVAATAANAAPAN	Phl p 5	Phleum pratense (timothy grass)	4	13
5320	AVFEAALTKAITAMS	Phl p 5	Phleum pratense (timothy grass)	3	11
15558	FEIKCTKPEACS	Phl p 1	Phleum pratense (timothy grass)	3	15
73596	YDTYKCIPSLEAAVK	Phl p 5	Phleum pratense (timothy grass)	3	11
74106	YHFDLSGHAFGA	Phl p 1	Phleum pratense (timothy grass)	3	8
125715	APEVKYTVFETALKK	Phl p 5	Phleum pratense (timothy grass)	3	3
126096	GELELQFRRVKCKYP	Phl p 1	Phleum pratense (timothy grass)	3	4
126098	GEVEIQFRRVKCKYP	Phl p 1	Phleum pratense (timothy grass)	3	3
126517	KYDAYVATLSEALRI	Phl p 5	Phleum pratense (timothy grass)	3	3
127300	VIPAGELQVIEKVDA	Phl p 5	Phleum pratense (timothy grass)	3	3
127373	WGAIWRIDTPDKLTG	Phl p 1	Phleum pratense (timothy grass)	3	5
1493	AGELELQFRRVK	Phl p 1	Phleum pratense (timothy grass)	2	10
10760	DVAVDIKEKGG	Phl p 1	Phleum pratense (timothy grass)	2	9
12313	EGWKADTSYESK	Phl p 1	Phleum pratense (timothy grass)	2	9
13855	EQKLRSAELEL	Phl p 1	Phleum pratense (timothy grass)	2	9
20116	GHAFGAMAKKGD	Phl p 1	Phleum pratense (timothy grass)	2	8
25389	IAPYHFDLSGHA	Phl p 1	Phleum pratense (timothy grass)	2	16

Epitopes: specific molecules (here:peptides) tested

Epitopes (600)		Antigens (9)		Assays (1259)		Receptors (0)		References (18)		
Go To Records Starting At						1200	GO		Export Results	
600 Records Found						Page 1 of 24		25	Per Page	
Details	Epitope	Antigen	Organism	# References	# Assays					
38854	LQIIDKIDAAFVAA	Phl p 5	Phleum pratense (timothy grass)	4	6					
125665	AFKVAATAANAAPAN	Phl p 5	Phleum pratense (timothy grass)	4	13					
5320	AVFEAALTKAITAMS	Phl p 5	Phleum pratense (timothy grass)	3	11					
15558	FEIKCTKPEACS	Phl p 1	Phleum pratense (timothy grass)	3	15					
73596	YDTYKCIPSLEAAVK	Phl p 5	Phleum pratense (timothy grass)	3	11					
74106	YHFDLSGHAFGA	Phl p 1	Phleum pratense (timothy grass)	3	8					
125715	APEVKYTVFETALKK	Phl p 5	Phleum pratense (timothy grass)	3	3					
126096	GELELQFRRVKCKYP	Phl p 1	Phleum pratense (timothy grass)	3	4					
126098	GEVEIQFRRVKCKYP	Phl p 1	Phleum pratense (timothy grass)	3	3					
126517	KYDAYVATLSEALRI	Phl p 5	Phleum pratense (timothy grass)	3	3					
127300	VIPAGELQVIEKVDA	Phl p 5	Phleum pratense (timothy grass)	3	3					
127373	WGAIWRIDTPDKLTG	Phl p 1	Phleum pratense (timothy grass)	3	5					
1493	AGELELQFRRVK	Phl p 1	Phleum pratense (timothy grass)	2	10					
10760	DVAVDIKEKGG	Phl p 1	Phleum pratense (timothy grass)	2	9					
12313	EGWKADTSYESK	Phl p 1	Phleum pratense (timothy grass)	2	9					
13855	EQKLRSGELEL	Phl p 1	Phleum pratense (timothy grass)	2	9					
20116	GHAFGAMAKKGD	Phl p 1	Phleum pratense (timothy grass)	2	8					
25389	IAPYHFDLSGHA	Phl p 1	Phleum pratense (timothy grass)	2	16					

Assays: Experiments in which epitope was tested

Epitopes (800)		Antigens (9)		Assays (1259)		Receptors (0)		References (18)	
T Cell Assays (1259)		B Cell Assays (0)		MHC Ligand Assays (0)					
Go To Records Starting At <input type="text" value="A,b"/> <input type="button" value="GO"/>									
1259 Records Found									
Page 1 of 51									
25 Per Page									
ID	Reference	Epitope	Host	Immunization	Assay Antigen	Antigen Epitope Relation	MHC Restriction	Assay Description	
1460417	W D Müller; Clin Exp Allergy 1998	AAGKATTEEQKLIED INVGFKA AVAAASV PAA Pollen allergen Phi p 5b precursor (35-67) Phleum pratense	Homo sapiens	Allergy to Pollen from Phleum pratense (Derivative of Source Organism) followed by restimulation in vitro	Pollen allergen Phi p 5b precursor Pollen allergen Phi p 5b precursor Phleum pratense	Source Antigen	HLA class II	3H-thymidine proliferation Positive	
1459860	P A Würtzen; Clin Exp Allergy 1999	AALTSKLDAAAYKLAY KTAEGATPEAKYDAY VATL Pollen allergen Phi p 5a (97-130) Phleum pratense	Homo sapiens	Allergy to Pollen from Phleum pratense (Derivative of Source Organism) followed by restimulation in vitro	AALTSKLDAAAYKLAY KTAEGATPEAKYDAY VATL Pollen allergen Phi p 5a (97-130) Phleum pratense	Epitope	HLA-DRB5*01:01	3H-thymidine proliferation Positive	
1459865	P A Würtzen; Clin Exp Allergy 1999	AALTSKLDAAAYKLAY KTAEGATPEAKYDAY VATL Pollen allergen Phi p 5a (97-130) Phleum pratense	Homo sapiens	Allergy to Pollen from Phleum pratense (Derivative of Source Organism) followed by restimulation in vitro	Pollen allergen Phi p 5a Pollen allergen Phi p 5a Phleum pratense	Source Antigen	HLA-DRB5*01:01	3H-thymidine proliferation Positive	
1459888	P A Würtzen; Clin Exp Allergy 1999	AALTSKLDAAAYKLAY KTAEGATPEAKYDAY VATL Pollen allergen Phi p 5a (97-130) Phleum pratense	Homo sapiens	Allergy to Pollen from Phleum pratense (Derivative of Source Organism) followed by restimulation in vitro	Major pollen allergen Lol p 5a precursor Major pollen allergen Lol p 5a precursor Lolium perenne	Taxonomic Sibling	HLA-DRB1*15:01	3H-thymidine proliferation Positive	
1459889	P A Würtzen; Clin Exp Allergy 1999	AALTSKLDAAAYKLAY KTAEGATPEAKYDAY VATL Pollen allergen Phi p 5a (97-130) Phleum pratense	Homo sapiens	Allergy to Pollen from Phleum pratense (Derivative of Source Organism) followed by restimulation in vitro	Major pollen allergen Lol p 5a precursor Major pollen allergen Lol p 5a precursor Lolium perenne	Taxonomic Sibling	HLA-DRB5*01:01	3H-thymidine proliferation Positive	
1459785	P A Würtzen; Clin Exp Allergy 1999	AAVAAAASVPAADKFKTFE group V allergen Phi p 5.0203 precursor (67-85) Phleum pratense	Homo sapiens	Allergy to Pollen from Phleum pratense (Derivative of Source Organism) followed by	AAVAAAASVPAADKFK TFE group V allergen Phi p 5.0203 precursor (67-85) Phleum pratense	Epitope	HLA class II	3H-thymidine proliferation Positive	

References: Source of information

Epitopes (1)		Antigens (1)		Assays (6)		Receptors (0)		References (4)	
Go To Records Starting At 1982 <input type="button" value="GO"/>									
4 Records Found Export Results <input type="button" value="GO"/>									
Page 1 of 1 25 Per Page									
Ref ID	PMID	Author	Title	Abstract	Date				
1027945	24708411	L D Archila; J H DeLong; E Wambre; E A James; D M Robinson; W W Kwok	Grass-specific CD4(+) T-cells exhibit varying degrees of cross-reactivity, implications for allergen-specific immunotherapy.	BACKGROUND: Conceptually, allergic responses may involve cross-reactivity by antibodies or T-cells. While IgE cross-reactivity among grass-pollen allergens has been observed, cross-reactivity at the a ...more...	2014				
1016852		Carla Oseroff*, John Sidney*, Maya F. Kotturi*, Ravi Kolla*, Rafeul Alam†, David H. Broide‡, Daniela Weiskopf*, Denise M. McKinney*, Jolan Chung*, Arnd Petersen§, Howard Grey*, Bjoern Peters* and Alessandro Sette*2	Molecular Determinants of T Cell Epitope Recognition to the Common Timothy Grass Allergen	We investigated the molecular determinants of allergen-derived T cell epitopes in humans utilizing the Phleum pratense (Phl p) allergen, common name timothy grass. PBMCs from allergic individuals wer ...more...	2010				
1019720	20554959	Carla Oseroff; John Sidney; Maya F Kotturi; Ravi Kolla; Rafeul Alam; David H Broide; Stephen I Wasserman; Daniela Weiskopf; Denise M McKinney; Jo L Chung; Arnd Petersen; Howard Grey; Bjoern Peters; Alessandro Sette	Molecular determinants of T cell epitope recognition to the common Timothy grass allergen.	We investigated the molecular determinants of allergen-derived T cell epitopes in humans utilizing the Phleum pratense (Timothy grass) allergens (Phl p). PBMCs from allergic individuals were tested in ...more...	2010				
1005163	9973522	G Schramm; H Kahlert; R Suck; B Weber; H T Stüwe; W D Müller; A Bufer; W M Becker; M W Schlaak; L Jäger; O Cromwell; H Fiebig	"Allergen engineering": variants of the timothy grass pollen allergen Phl p 5b with reduced IgE-binding capacity but conserved T cell reactivity.	One problem of conventional allergen-specific immunotherapy is the risk of anaphylactic reactions. A new approach to make immunotherapy safer and more efficient might be the application of engineered ...more...	1999				

Antigens: Identifying protein source of epitopes (isoforms)

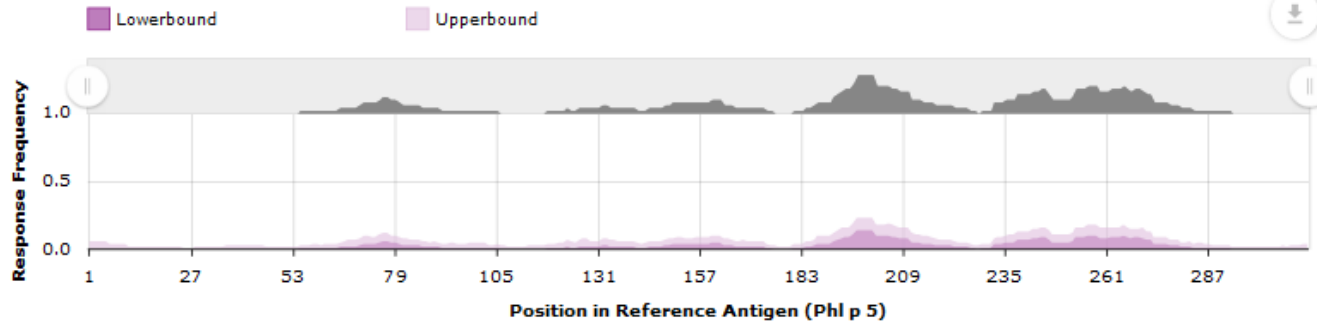
Epitopes (600)	Antigens (9)	Assays (1259)	Receptors (0)	References (18)
Go To Records Starting At <input type="text" value="1200"/> <input type="button" value="GO"/>				
9 Records Found				
Page 1 of 1				
25 Per Page				
Antigen	Organism	# Epitopes	# Assays	# References
Phl p 5	Phleum pratense (timothy grass)	124	325	12
Phl p 1	Phleum pratense (timothy grass)	90	338	10
Other Phleum pratense (timothy grass) protein	Phleum pratense (timothy grass)	353	513	3
Phl p 12	Phleum pratense (timothy grass)	11	12	3
Phl p 2	Phleum pratense (timothy grass)	7	18	2
Phl p 4	Phleum pratense (timothy grass)	8	34	2
Phl p 11	Phleum pratense (timothy grass)	1	2	2
Phl p 13	Phleum pratense (timothy grass)	5	16	2
Phl p 6	Phleum pratense (timothy grass)	1	1	1

Phleum pratense (timothy grass) - Phl p 5

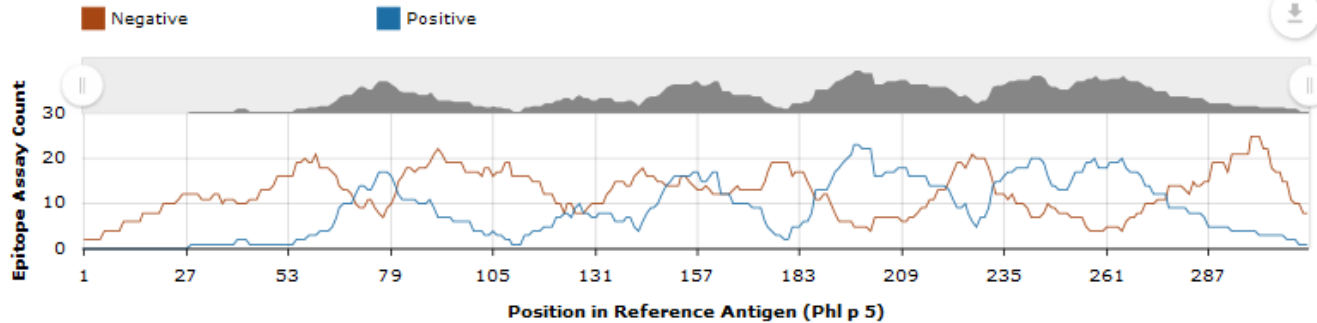
Change Parameters

Pending Filters Positive Assays Only Organism: Phleum pratense (timothy grass) (ID:15957, timothy) No B cell assays No MHC ligand assays
 Host: Homo sapiens (human) Disease Data: Allergic Disease

Response Frequency



Epitope Assay Counts



Controls

Residue Position Start End

Reset

Update Display

Results Returned: 264 | Displaying: 264 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)
126666	MAVHQYTVALFLAVA	1-15	100%	50	0	0	2	0.00 (0.00-0.06)
127489	VETVLEFLAVLAVCF	8-20	100%	50	0	0	2	0.00 (0.00-0.06)

Epitope ID	Epitope Sequence	Mapped Position	Identity	Subjects Tested	Subjects Responded	Assays Positive	Assays Negative	Response Freq.(95% CI)
126666	MAVHQYTVALFLAVA	1-15	100%	50	0	0	2	0.00 (0.00:0.06)
127489	YTVLFLAVALVAGP	6-20	100%	50	0	0	2	0.00 (0.00:0.06)
125999	FLAVALVAGPAGSYA	11-25	93%	50	0	0	2	0.00 (0.00:0.06)
126843	PRGGPGRSYAADAGY	16-30	60%	50	0	0	2	0.00 (0.00:0.06)
126633	LVAGPAGSYAADLGY	16-30	93%	50	0	0	2	0.00 (0.00:0.06)
125675	AGSYAADLGYGPATP	21-35	93%	50	0	0	2	0.00 (0.00:0.06)
126173	GRSYAADAGYAPATP	21-35	73%	50	0	0	2	0.00 (0.00:0.06)
176861	AADLGYGPATPAAPA	25-39	100%	11	0	0	1	0.00 (0.00:0.23)
225940	ADLGYGPATPAAPAAGYTPATPAA PAEAAPAGK	26-58	100%	13	0	0	1	0.00 (0.00:0.20)
125654	ADLGYGPATPAAPAA	26-40	100%	50	0	0	2	0.00 (0.00:0.06)
177152	LGYGPATPAAPAAAGY	28-42	100%	11	1	1	0	0.09 (0.00:0.35)
126160	GPATPAAPAAAGYTPA	31-45	100%	61	0	0	3	0.00 (0.00:0.06)
177330	TPAAPAAAGYTPATPA	34-48	100%	11	0	0	1	0.00 (0.00:0.23)
125643	AAPAAAGYTPATPAAP	36-50	100%	50	0	0	2	0.00 (0.00:0.06)
176966	APAAAGYTPATPAAPA	37-51	100%	11	0	0	1	0.00 (0.00:0.23)
176959	AGYTPATPAAPAEAA	40-54	100%	11	1	1	0	0.09 (0.00:0.35)
126204	GYTPATPAAPAGAEF	41-55	86%	50	0	0	2	0.00 (0.00:0.06)
177332	TPATPAAPAEAPAG	43-57	100%	11	0	0	1	0.00 (0.00:0.23)
127232	TPAAPAGAEAPAGKAT	46-60	86%	50	0	0	2	0.00 (0.00:0.06)
177331	TPAAPAEAPAGKAT	46-60	100%	11	0	0	1	0.00 (0.00:0.23)
126543	LGASPYKLGSPFKAR	46-60	33%	50	0	0	2	0.00 (0.00:0.06)
176967	APAEAPAGKATTEE	49-63	100%	11	0	0	1	0.00 (0.00:0.23)
241044	PAAGAAAGKATTEEQKLIE	49-68	75%	1	0	0	1	0.00 (0.00:0.94)
125631	AAAGAEAGKATTEEQ	50-64	73%	50	0	0	2	0.00 (0.00:0.06)
125669	AGAEAGKATTEEQK	51-65	86%	50	0	0	2	0.00 (0.00:0.06)
176998	EAPAGKATTEEQKL	52-66	100%	11	0	0	1	0.00 (0.00:0.23)
160	AAGKATTEEQKLIEDINVGFKAAV AAAASVPAA	55-87	78%	18	5	1	0	0.28 (0.12:0.49)
177203	PAGKATTEEQKLIEK	55-69	100%	11	0	0	1	0.00 (0.00:0.23)
125859	PAAGAAAGKATTEEQKLIE	55-69	100%	50	0	0	2	0.00 (0.00:0.06)

The Submission Community

- Currently there are over 10 epitope discovery contracts and grants
 - 10 contracts for infectious disease B and T cell epitopes
 - Other grants submit allergy epitopes
- There have been 24 epitope discovery contracts previously
- Data submission metrics:
 - 330 submissions
 - 3,477,767 total epitopes
 - Submitted data currently comprises 25% of epitopes in the IEDB
- Data deposition is open to the general research community on a case-by-case basis

Promote Awareness of IEDB Data and Tools

- Present 4 exhibit booths per year
- Organize annual user workshop
- Publish IEDB related papers
- Expand help with video and written tutorials and integration of field-level help linked to ontology



Our goals for this user workshop

We want your input to make the IEDB better:

- Learn about real-life applications for the IEDB
- Identify and prioritize problems with the user interface, documentation, functionality etc.

We want to enable you to get the most out of the IEDB:

- The primary IEDB success metric is usage
- Best compliment for our program is if IEDB data & tools help in your research (citations)