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Immune Epitope Database and Analysis Resource Program

2018 Annual IEDB Compendium

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Introduction

The Immune Epitope Database and Analysis Resource (IEDB) is a public repository of immune epitope data and is sponsored by the National Institute for Allergy and Infectious Diseases (NIAID). The IEDB development started in December 2003 and it became available to the public in a beta test phase on 15 February 2006. The IEDB primarily contains data related to antibody and T cell epitopes for humans, non-human primates, rodents, and other animal species. The IEDB also makes available a variety of analytical and epitope prediction tools and resources within its Analysis Resource.

This Compendium of the Immune Epitope Database and Analysis Resource, and consists of three sections. The first section contains a list of the antibody and T cell epitope information in the database as of 14 January 2019. The second section describes the features of the IEDB 3.10 website and the Analysis Resource 2.20. The third section lists the scientific publications in 2018 for which the IEDB played a contributory role.

Since the publication of last year's 2017 Annual Compendium, the quantity of data available in the IEDB continues to increase significantly. As of January 2019, the IEDB contains data for over 850,000 epitopes, 47,000 antigens, 1,900,000 assays, and 25,000 receptors from more than 19,000 references. The focus of the IEDB remains on peptidic and non-peptidic epitope data relating to infectious diseases, allergens, autoimmune diseases, and transplant/alloantigens; with exceptions in respect to cancer and HIV.

1 Antibody and T Cell Epitopes

Many new references and many new species were added to the IEDB in 2018, as demonstrated in Table 1.1. The table lists the number of distinct B cell and T cell epitopes in the database by source species at the end of 2017 and 2018. Of the 3,689 species/strains listed, 74 were added in 2018. It should be noted that the source organism is the species/strain from which the epitopes originate, and may not be from an infecting organism or vaccine target. The curation of MHC binding peptides, cross-reactive epitopes, and autoimmune epitopes has resulted in the appearance of human (Homo sapiens) and mouse (Mus musculus) epitopes on the list.

In the table below, the leftmost column labeled "New" indicates with an "X" if epitopes for the species/strain was added to the IEDB in 2018. A font color of red is used to highlight the information in the row. The Organism ID matches the NCBI taxonomy ID if it exists. Otherwise it represents an IEDB-assigned identifier, which are eight digit numbers starting with “1000”. These are easily distinguishable from the NCBI identifiers which are six digits or less. The columns labeled "B-17", "T-17", "B-18", and "T-18" indicate the cumulative number of distinct B cell and T cell epitopes in the database at the end of 2017 and 2018, respectively. The two rightmost columns display the differences in the B and T cell epitope counts from 2017 to 2018. The changes in B and T cell epitope counts are shown in red. In 2018, the number of B cell epitopes increased by 5,605 from 44,803 to 50,408 and the number of T cell epitopes increased by 72,798 from 388,409 to 461,207.

Table 1.1 Summary of B and T cell epitopes contained in the IEDB

ID	NEW 2018	ORGANISM ID	SPECIES / STRAIN	B_17	T_17	B_18	T_18	DELTA B	DELTA T
1		2	Bacteria	45		45			
2		106	Runella slithyformis		1		1		
3		108	Spirosoma linguale	1		1			
4		139	Borreliella burgdorferi	65	43	78	43	13	
6		158	Treponema denticola		1		1		
7		160	Treponema pallidum	7	2	7	2		
8		173	Leptospira interrogans	6	4	6	4		
9		195	Campylobacter coli		2		2		
10		197	Campylobacter jejuni	103	29	108	29	5	
11		210	Helicobacter pylori	47	56	47	56		
12		234	Brucella		28		28		
13		235	Brucella abortus	7	39	7	39		
14		236	Brucella ovis		3		3		
15		263	Francisella tularensis	4	14	4	14		
16		266	Paracoccus denitrificans	3		3			
17		271	Thermus aquaticus	1		1			
18		274	Thermus thermophilus	1	1	1	1		
19		280	Xanthobacter autotrophicus		1		1		
20		286	Pseudomonas	1		1			
21		287	Pseudomonas aeruginosa	78	162	79	162	1	
22		292	Burkholderia cepacia	3	2	3	2		
23		294	Pseudomonas fluorescens		4		4		
25		300	Pseudomonas mendocina		1		1		
26		303	Pseudomonas putida	1	8	1	8		
27		306	Pseudomonas sp.		1		1		
28		312	Pseudomonas sp. RS-16	1		1			
30		319	Pseudomonas savastanoi pv. phaseolicola	1		1			
31		354	Azotobacter vinelandii		2		2		
32		358	Agrobacterium tumefaciens	1	2	1	2		
33		382	Sinorhizobium meliloti		1		1		
34		384	Rhizobium leguminosarum		1		1		
35		446	Legionella pneumophila	1	1	1	1		
36		470	Acinetobacter baumannii		1	2	1	2	
37		471	Acinetobacter calcoaceticus		1		1		
38		480	Moraxella catarrhalis	10		10			
39		485	Neisseria gonorrhoeae	76	15	77	15	1	
40		487	Neisseria meningitidis	87	23	88	23	1	
41		491	Neisseria meningitidis serogroup B	40	1	46	1	6	
42		511	Alcaligenes faecalis	3	2	3	2		
43		520	Bordetella pertussis	338	218	338	218		
44		543	Enterobacteriaceae	3		4		1	
45		544	Citrobacter	1		1			
46		546	Citrobacter freundii	1		1			
47		548	Klebsiella aerogenes		1		1		
48		550	Enterobacter cloacae		9		9		
49		554	Pectobacterium carotovorum	2		2			
51		562	Escherichia coli	246	149	257	150	11	1
52		573	Klebsiella pneumoniae	29	9	29	9		
53		582	Morganella morganii	1		1			
54		583	Proteus	2		2			
55		584	Proteus mirabilis	7		7			
57		590	Salmonella	3		3			
58		596	Salmonella enterica subsp. enterica serovar Muenchen	1		1			
59		599	Salmonella sp.	1		1			
60		605	Salmonella enterica subsp. enterica serovar Pullorum		1		1		
61	X	611	Salmonella enterica subsp. enterica serovar Heidelberg			9		9	
62		615	Serratia marcescens	1	3	1	3		
63		621	Shigella boydii		2		2		
64		622	Shigella dysenteriae	6	2	6	2		
65		623	Shigella flexneri	77	11	77	11		
66		624	Shigella sonnei		1		1		
67		630	Yersinia enterocolitica	6	28	6	28		

68		632	Yersinia pestis	24	324	24	324		
69		633	Yersinia pseudotuberculosis		2		2		
71		644	Aeromonas hydrophila	7	2	9	3	2	1
72		645	Aeromonas salmonicida	59		59			
73		659	Photobacterium phosphoreum		1		1		
74		666	Vibrio cholerae	38	90	38	91		1
75		670	Vibrio parahaemolyticus		57		57		
76		671	Vibrio proteolyticus	1		1			
77		672	Vibrio vulnificus	1	66	1	66		
78		674	Vibrio mimicus	2		2			
79		686	Vibrio cholerae O1 biovar El Tor	3	1	3	1		
80		703	Plesiomonas shigelloides		2		2		
81		714	Aggregatibacter actinomycetemcomitans	1	4	1	4		
82		715	Actinobacillus pleuropneumoniae		2		2		
83		727	Haemophilus influenzae	30	68	30	68		
84		730	[Haemophilus] ducreyi	3	2	3	2		
85		738	Glaesserella parasuis	1		1			
86		747	Pasteurella multocida	1	10	1	10		
87		769	Anaplasma centrale		2		2		
88		770	Anaplasma marginale	17	14	17	14		
89		777	Coxiella burnetii	2	201	2	201		
90		779	Ehrlichia ruminantium	3		3			
91		781	Rickettsia conorii		13		13		
92		782	Rickettsia prowazekii		23		23		
93		783	Rickettsia rickettsii		1		1		
94		784	Orientia tsutsugamushi	87		87			
95		785	Rickettsia typhi		3		3		
96		787	Rickettsia australis		1		1		
97		788	Rickettsia canadensis		1		1		
98		813	Chlamydia trachomatis	128	69	178	69	50	
99		817	Bacteroides fragilis		3		3		
100		837	Porphyromonas gingivalis	91	21	91	21		
101		920	Acidithiobacillus ferrooxidans		1		1		
102		944	Ehrlichia canis	7	1	7	1		
103		945	Ehrlichia chaffeensis	14	1	14	1		
105		948	Anaplasma phagocytophilum	29		33		4	
106		955	Wolbachia pipientis	1		1			
107		1006	Marivirga tractuosa		1		1		
108		1018	Capnocytophaga ochracea		1		1		
109		1019	Capnocytophaga sputigena		1		1		
110		1022	Beggiatoa alba	1		1			
111		1063	Rhodobacter sphaeroides		1		1		
112		1076	Rhodopseudomonas palustris		2		2		
113		1224	Proteobacteria	3		3			
114		1245	Leuconostoc mesenteroides	1		1			
115		1254	Pediococcus acidilactici	1		1			
116		1260	Finegoldia magna		1		1		
117		1265	Ruminococcus flavefaciens		1		1		
118		1270	Micrococcus luteus	1		1			
119		1279	Staphylococcus	1		1			
120		1280	Staphylococcus aureus	132	46	134	46	2	
122		1292	Staphylococcus warneri	1		1			
123		1299	Deinococcus radiodurans	3		3			
124		1301	Streptococcus	5		5			
125		1303	Streptococcus oralis	12		12			
127		1305	Streptococcus sanguinis		1		1		
128		1307	Streptococcus suis	1		1			
129		1309	Streptococcus mutans	146	89	146	89		
130		1310	Streptococcus sobrinus	1		1			
131		1311	Streptococcus agalactiae	6		18		12	
132		1313	Streptococcus pneumoniae	87	8	90	8	3	
133		1314	Streptococcus pyogenes	376	115	377	115	1	
134		1317	Streptococcus downei	2	1	2	1		
135		1319	Streptococcus sp. 'group B'			1		1	
137		1324	Streptococcus sp. G148	14	5	14	5		
138		1334	Streptococcus dysgalactiae	3	6	3	6		

139		1336	Streptococcus equi	22	14	22	14		
140		1349	Streptococcus uberis	8		8			
141		1351	Enterococcus faecalis	2		2			
142		1352	Enterococcus faecium	6		6			
143		1358	Lactococcus lactis		2		2		
144		1390	Bacillus amyloliquefaciens	18	3	18	3		
145		1392	Bacillus anthracis	399	209	399	209		
146		1396	Bacillus cereus	1	8	1	8		
147		1402	Bacillus licheniformis		10		10		
148		1404	Bacillus megaterium		1		1		
149		1405	Bacillus mycoides		1		1		
150		1408	Bacillus pumilus		1		1		
151		1422	Geobacillus stearothermophilus	2	1	2	1		
152		1423	Bacillus subtilis	2	4	2	4		
153		1428	Bacillus thuringiensis	7	7	7	7		
154		1435	Bacillus thuringiensis serovar san diego		2		2		
155		1467	Bacillus lentus		1		1		
156		1491	Clostridium botulinum	194	99	196	112	2	13
157		1496	Clostridioides difficile	57	1	63	1	6	
158		1502	Clostridium perfringens	41	1	41	1		
159		1513	Clostridium tetani	78	272	79	272	1	
160		1520	Clostridium beijerinckii	1		1			
161		1585	Lactobacillus delbrueckii subsp. bulgaricus	1		1			
162		1599	Lactobacillus sakei		1		1		
163		1604	Lactobacillus amylovorus		1		1		
165		1638	Listeria ivanovii	1	1	1	1		
166		1639	Listeria monocytogenes	21	99	22	99	1	
167		1641	Listeria grayi		1		1		
168		1642	Listeria innocua	2	3	2	3		
169		1646	Renibacterium salmoninarum	12		12			
170		1661	Trueperella pyogenes	7		7			
171		1681	Bifidobacterium bifidum		1		1		
172		1717	Corynebacterium diphtheriae	15	52	15	52		
173		1718	Corynebacterium glutamicum		26		26		
174		1747	Cutibacterium acnes		2		2		
175		1752	Propionibacterium freudenreichii subsp. shermanii		1		1		
176		1763	Mycobacterium	3	19	29	20	26	1
177		1764	Mycobacterium avium	6	16	6	17		1
178		1765	Mycobacterium tuberculosis variant bovis	48	326	49	326	1	
179		1766	Mycolicibacterium fortuitum		1		1		
180		1767	Mycobacterium intracellulare		1		1		
181		1768	Mycobacterium kansasii	9	13	9	13		
182		1769	Mycobacterium leprae	119	409	120	409	1	
183		1770	Mycobacterium avium subsp. paratuberculosis	105	15	105	15		
184		1771	Mycolicibacterium phlei		1		1		
185		1772	Mycolicibacterium smegmatis		24		28		4
186		1773	Mycobacterium tuberculosis	622	2522	642	2530	20	8
187		1774	Mycobacteroides chelonae	1		1			
188		1778	Mycobacterium gordonae	1		1			
189		1781	Mycobacterium marinum		1		1		
190		1783	Mycobacterium scrofulaceum	4		4			
191		1795	Mycolicibacterium neoaurum		1		1		
192		1804	Mycolicibacterium gilvum		1		1		
193		1809	Mycobacterium ulcerans		10		10		
195		1828	Rhodococcus fascians		2		2		
196		1830	Rhodococcus ruber		1		1		
197		1833	Rhodococcus erythropolis		2		2		
198	X	1836	Saccharopolyspora erythraea			1		1	
199	X	1895	Streptomyces avidinii			1		1	
200		1902	Streptomyces coelicolor		2		2		
201		1916	Streptomyces lividans	10		10			
202		1946	Streptomyces kasugaensis		1		1		
203		2039	Tropheryma whipplei	1		1			
204		2097	Mycoplasma genitalium		1		1		
205		2099	Mycoplasma hyopneumoniae	2		2			
206		2104	Mycoplasma pneumoniae	12	2	16	2	4	

208		2133	Spiroplasma citri		1		1		
209		2147	Acholeplasma	1		1			
210		2148	Acholeplasma laidlawii		2		2		
211		2190	Methanocaldococcus jannaschii		1		1		
212		2234	Archaeoglobus fulgidus	1	1	1	1		
213		2242	Halobacterium salinarum	1		1			
214		2287	Saccharolobus solfataricus	1		1			
215		2439	Plasmid ColB2	1		1			
216		2465	Plasmid F	1		1			
218		2759	Eukaryota	1		1			
219	X	2864	Dinophyceae			1		1	
220		2903	Emiliania huxleyi		1		1		
221		3039	Euglena gracilis	1		1			
222		3068	Volvox carteri f. nagariensis		1		1		
223		3318	Pinaceae	2		2			
224		3352	Pinus taeda	4		4			
225		3369	Cryptomeria japonica	44	299	45	299	1	
226		3469	Papaver somniferum	1		1			
227		3505	Betula pendula	76	335	85	335	9	
228		3513	Quercus alba		5		5		
229		3517	Alnus glutinosa		17		17		
230		3562	Spinacia oleracea	4		4			
232		3617	Fagopyrum esculentum	40		40			
233		3645	Bertholletia excelsa	7	24	7	24		
234		3656	Cucumis melo	13		13			
235		3677	Trichosanthes kirilowii	3		4		1	
236		3702	Arabidopsis thaliana	2	10	3	10	1	
237		3704	Armoracia rusticana	5		5			
238		3707	Brassica juncea	9		9			
240	X	3711	Brassica rapa			1		1	
241		3726	Raphanus sativus	1		1			
242		3728	Sinapis alba	2		2			
243		3750	Malus domestica	27	48	27	48		
244		3755	Prunus dulcis	19		19			
245		3758	Prunus domestica	4		4			
246		3760	Prunus persica	18	51	18	51		
247		3816	Abrus precatorius	1		1			
248		3818	Arachis hypogaea	455	193	458	263	3	70
249		3847	Glycine max	193	2	195	2	2	
250		3864	Lens culinaris	19		19			
251		3885	Phaseolus vulgaris	5	1	10	3	5	2
253		3972	Viscum album	17		17			
254		3981	Hevea brasiliensis	170	43	170	43		
255		3988	Ricinus communis	52	6	61	6	9	
256		4012	Rhus		1		1		
257		4026	Acer pseudoplatanus	1		1			
258		4039	Daucus carota		46		46		
259		4045	Apium graveolens		14		14		
260		4081	Solanum lycopersicum	3		3			
261		4097	Nicotiana tabacum	5		5			
262		4100	Nicotiana benthamiana	5		5			
264		4146	Olea europaea	70	19	70	19		
265		4163	Digitalis	1		1			
266		4182	Sesamum indicum	11		11			
267		4212	Ambrosia artemisiifolia	4	215	4	215		
268		4214	Ambrosia trifida		10		10		
269		4215	Ambrosia artemisiifolia var. elatior	9	12	9	12		
270		4220	Artemisia vulgaris	1	70	1	70		
271		4232	Helianthus annuus	18		18			
272		4498	Avena sativa		16		16		
273		4509	Dactylis glomerata		12		12		
274		4513	Hordeum vulgare		26		26		
275		4522	Lolium perenne	44	122	44	123		1
276		4530	Oryza sativa	2		2			
277		4545	Poa pratensis	34	35	34	35		
278		4550	Secale cereale	51	42	51	42		

279		4558	Sorghum bicolor		1		1		
280		4565	Triticum aestivum	649	577	649	577		
281		4567	Triticum turgidum subsp. durum		1		1		
282		4568	Triticum monococcum		1		1		
284		4577	Zea mays	3	1	3	1		
285		4606	Festuca arundinacea	1		1			
286		4615	Ananas comosus	3		3			
287		4641	Musa acuminata	50	1	50	1		
288	X	4751	Fungi			2		2	
289		4754	Pneumocystis carinii	2	1	2	1		
290		4903	Cyberlindnera jadinii	12		12			
291		4932	Saccharomyces cerevisiae	28	14	29	14	1	
292		5039	Blastomyces dermatitidis		1		1		
293		5061	Aspergillus niger		1		1		
294		5064	Aspergillus restrictus	1		1			
295		5067	Aspergillus parasiticus		1		1		
296		5076	Penicillium chrysogenum	45	19	45	19		
297		5077	Penicillium citrinum	13		13			
298		5141	Neurospora crassa	6	3	6	3		
299		5207	Cryptococcus neoformans	2	2	2	2		
300		5334	Schizophyllum commune		1	1	1	1	
301		5476	Candida albicans	107	80	107	80		
302		5480	Candida parapsilosis	1		1			
303		5501	Coccidioides immitis		1		1		
304		5503	Curvularia lunata	20	10	20	10		
305		5551	Trichophyton rubrum	2	27	2	27		
306		5554	Cutaneotrichosporon cutaneum	1		1			
307		5599	Alternaria alternata	5	36	5	36		
308		5658	Leishmania	4		4			
309		5659	Leishmania amazonensis		15		15		
310		5660	Leishmania braziliensis	6		6			
311		5661	Leishmania donovani	16	55	25	84	9	29
312		5664	Leishmania major	18	184	25	184	7	
313		5665	Leishmania mexicana	2	3	2	3		
314		5667	Leishmania aethiopica	16		16			
315		5671	Leishmania infantum	99	9	102	9	3	
316		5679	Leishmania panamensis	3	7	3	7		
317		5682	Leishmania pifanoi		20		20		
318		5691	Trypanosoma brucei	13	6	13	6		
319		5692	Trypanosoma congolense	1		1			
320		5693	Trypanosoma cruzi	159	454	161	454	2	
321		5702	Trypanosoma brucei brucei	5		5			
322		5722	Trichomonas vaginalis	75	1	75	1		
323		5741	Giardia intestinalis	1	13	1	13		
324		5755	Acanthamoeba castellanii	14	3	14	3		
325		5759	Entamoeba histolytica	30	14	30	14		
326		5801	Eimeria acervulina	1		1			
327		5802	Eimeria tenella	6		6			
328		5807	Cryptosporidium parvum	4	31	4	31		
329		5811	Toxoplasma gondii	78	99	83	103	5	4
330		5820	Plasmodium	3	4	3	4		
331		5821	Plasmodium berghei	14	50	14	50		
332		5823	Plasmodium berghei ANKA	7	64	7	65		1
333		5824	Plasmodium brasilianum	2		2			
334		5825	Plasmodium chabaudi	4	4	4	4		
335		5827	Plasmodium cynomolgi	2		2			
337		5833	Plasmodium falciparum	762	813	778	813	16	
338		5834	Plasmodium falciparum RO-33	8	1	8	1		
339		5835	Plasmodium falciparum CAMP/Malaysia	36	3	36	3		
340		5836	Plasmodium falciparum CDC/Honduras	18		18			
341		5837	Plasmodium falciparum FC27/Papua New Guinea	47	60	47	60		
342		5838	Plasmodium falciparum FCR-3/Gambia	94		94			
343		5839	Plasmodium falciparum K1	18	19	18	19		
344		5840	Plasmodium falciparum LE5		2		2		
345		5841	Plasmodium falciparum Mad20/Papua New Guinea	8	47	8	47		
346		5842	Plasmodium falciparum NF7/Ghana	5		5			

347		5843	Plasmodium falciparum NF54	13	31	20	31	7	
348		5846	Plasmodium falciparum T4/Thailand	25	1	25	1		
349		5848	Plasmodium falciparum isolate WELLCOME	25	51	25	51		
350		5850	Plasmodium knowlesi	2	17	2	17		
351		5851	Plasmodium knowlesi strain H	41	10	41	10		
352		5852	Plasmodium knowlesi strain Nuri		10		10		
353		5855	Plasmodium vivax	127	156	138	176	11	20
354		5857	Plasmodium fragile		5		5		
355		5858	Plasmodium malariae	1		1			
356		5861	Plasmodium yoelii	17	39	17	39		
357		5865	Babesia bovis	3	8	3	8		
358		5866	Babesia bigemina		3		3		
359		5868	Babesia microti	2		5		3	
360		5872	Theileria equi	8		8			
361		5874	Theileria annulata	1		1			
362		5875	Theileria parva	28	20	28	20		
364		6035	Encephalitozoon cuniculi		5		5		
365		6100	Aequorea victoria	3	5	3	5		
366		6181	Schistosoma	3		3			
367		6182	Schistosoma japonicum	43	53	43	53		
368		6183	Schistosoma mansoni	82	50	99	52	17	2
369		6184	Schistosoma bovis	2		2			
370		6192	Fasciola hepatica	272	28	298	28	26	
371		6203	Taenia ovis	8		8			
372		6204	Taenia solium	28	4	28	4		
373		6206	Taenia saginata	7		13		6	
374		6207	Taenia crassiceps	11	1	11	1		
375		6210	Echinococcus granulosus	39		41	2	2	2
376		6211	Echinococcus multilocularis	6		6			
377		6238	Caenorhabditis briggsae	1		1			
378		6239	Caenorhabditis elegans	2	10	2	10		
380		6253	Ascaris suum	1	1	1	1		
381		6265	Toxocara canis	3		3			
382		6269	Anisakis simplex	38	28	38	28		
383		6279	Brugia malayi	10	5	10	5		
384		6280	Brugia pahangi	1		1			
385		6282	Onchocerca volvulus	3	39	3310	39	3307	
386		6289	Haemonchus contortus	3		3			
387		6293	Wuchereria bancrofti	13	8	13	8		
388		6299	Litomosoides carinii	3		3			
389		6334	Trichinella spiralis	16	7	16	7		
390		6339	Heligmosomoides polygyrus	3		3			
391		6421	Hirudo medicinalis		3		3		
392		6454	Haliotis rufescens	1		1			
393		6491	Conus geographus	30		30			
394		6492	Conus magus	2		2			
395		6493	Conus striatus	11		11			
397		6536	Helix pomatia	1		1			
398		6594	Macrocallista nimbosa	1		1			
399		6661	Artemia franciscana	2		2			
400		6687	Penaeus monodon	10	23	10	23		
401		6689	Penaeus vannamei	140		140			
402		6690	Penaeus aztecus	51	31	51	31		
403		6728	Procambarus clarkii	3		3			
404	X	6761	Scylla serrata			13		13	
405		6850	Limulus polyphemus		1		1		
406		6853	Tachypleus tridentatus	1		1			
407		6858	Androctonus australis	9		9			
408		6860	Androctonus mauritanicus mauritanicus	1		1			
409		6878	Centruroides noxius	10		10			
410		6887	Tityus serrulatus	92		92			
411		6925	Latrodectus tredecimguttatus		1		1		
412		6938	Ornithodoros moubata	20		20			
413		6941	Rhipicephalus microplus	1		1			
414		6945	Ixodes scapularis	11		11			
415		6953	Dermatophagoides		578		578		

416		6954	Dermatophagoides farinae	33	111	35	111	2	
417		6956	Dermatophagoides pteronyssinus	83	300	109	300	26	
418		6958	Euroglyphus maynei		10		10		
419		6973	Blattella germanica	23	501	23	501		
420		6978	Periplaneta americana	16	6	22	6	6	
421	X	7088	Lepidoptera				1		1
422		7108	Spodoptera frugiperda		4		4		
423		7130	Manduca sexta		3		3		
424		7137	Galleria mellonella	1		2		1	
425		7154	Chironomus thummi	2	3	2	3		
426		7155	Chironomus thummi thummi	58	27	58	27		
427		7160	Aedes albopictus	7		7			
428		7165	Anopheles gambiae	8	2	8	2		
429		7227	Drosophila melanogaster	9	17	10	17	1	
430		7234	Drosophila persimilis	1		1			
431		7386	Sarcophaga peregrina		1		1		
432		7441	Dolichovespula maculata	11	20	11	20		
433		7444	Vespa basalis	1		1			
434		7453	Vespula maculifrons	1		1			
435		7454	Vespula vulgaris	2	95	2	95		
436		7460	Apis mellifera	15	106	15	106		
437		7469	Apis mellifera ligustica		1		1		
438		7515	Ctenocephalides felis		2		2		
439		7719	Ciona intestinalis	2		2			
440		7726	Styela plicata	6		6			
441		7742	Vertebrata	4		4			
442		7777	Chondrichthyes	1		1			
443		7787	Tetronarce californica	149	75	149	75		
444		7788	Torpedo marmorata	3	3	3	3		
445		7955	Danio rerio	1	3	2	3	1	
446		7957	Carassius auratus	3	1	3	1		
447		7962	Cyprinus carpio	4	1	4	1		
448		8005	Electrophorus electricus	3		4		1	
449		8018	Oncorhynchus keta		6		6		
450		8022	Oncorhynchus mykiss	1		1			
451		8030	Salmo salar	31		31			
452		8049	Gadus morhua	43		43			
453		8053	Gadus morhua callarias	10		10			
454		8090	Oryzias latipes	2	1	2	1		
455		8255	Paralichthys olivaceus	1		1			
456		8355	Xenopus laevis	4	3	4	3		
457		8364	Xenopus tropicalis	2	2	2	2		
458	X	8554	Heloderma suspectum				1		1
459		8613	Bungarus fasciatus	1		1			
460		8616	Bungarus multicinctus	17	3	17	3		
461	X	8620	Dendroaspis polylepis polylepis			22		22	
462		8654	Naja nigricollis	3	2	3	2		
464		8656	Naja atra	8		14		6	
465		8657	Naja oxiana	4		4			
466		8658	Naja pallida	1	1	1	1		
467		8663	Notechis scutatus	2		2			
468		8667	Oxyuranus scutellatus scutellatus	4		4			
469		8671	Pseudechis porphyriacus	3		3			
470		8704	Vipera ammodytes	1		1			
471		8722	Bothrops asper	1		1			
473		8725	Bothrops atrox	5		13		8	
474		8726	Bothrops jararacussu	13		13			
475		8732	Crotalus durissus terrificus	4		4			
476		8753	Lachesis muta muta	45		45			
477		8801	Struthio camelus	2		2			
478	X	8839	Anas platyrhynchos			2		2	
479		8845	Anser cygnoides	2		2			
480		8855	Cairina moschata	2	1	2	1		
481		8932	Columba livia		10		10		
482		8996	Numida meleagris	1		1			
483		9014	Colinus virginianus	1	3	1	3		

484		9031	Gallus gallus	331	337	338	346	7	9
485		9057	Phasianus colchicus colchicus	1		1			
487		9103	Meleagris gallopavo	5		6		1	
488		9258	Ornithorhynchus anatinus		1		1		
489		9322	Macropus sp.	1		1			
490		9337	Trichosurus vulpecula	45		45			
491		9397	Chiroptera	1		1			
492		9447	Lemur catta	1		1			
493		9479	Platyrrhini	1		1			
494		9483	Callithrix jacchus		4	1	4	1	
495		9488	Saguinus mystax	1		1			
496		9491	Saguinus imperator	1		1			
497		9502	Alouatta caraya	1		1			
498		9505	Aotus trivirgatus	1		1			
499		9509	Ateles geoffroyi		1		1		
500		9510	Ateles paniscus	1		1			
501		9511	Ateles sp.	1		1			
502		9515	Sapajus apella	1		1			
503		9519	Lagothrix lagotricha	1		1			
504		9521	Saimiri sciureus	1		1			
505		9534	Chlorocebus aethiops		5		5		
506		9538	Erythrocebus patas		1		1		
507		9541	Macaca fascicularis	3	3	3	3		
508		9544	Macaca mulatta	2	5	3	5	1	
509		9548	Macaca radiata	14	1	14	1		
510		9555	Papio anubis	1		1			
511		9556	Papio cynocephalus	1		1			
512		9580	Hylobates lar		1		1		
513		9593	Gorilla gorilla		2		2		
514		9595	Gorilla gorilla gorilla		6		6		
515		9597	Pan paniscus		1		1		
516		9598	Pan troglodytes	7	25	7	25		
517		9600	Pongo pygmaeus		2		2		
518		9601	Pongo abelii		2		2		
519		9606	Homo sapiens	8503	246334	9022	298230	519	51896
520		9615	Canis lupus familiaris	12	1539	17	1575	5	36
521		9627	Vulpes vulpes	1		1			
522		9666	Mustela lutreola	1		1			
523		9685	Felis catus	40	99	40	99		
524		9721	Cetacea	1		1			
525		9755	Physeter catodon	1	34	1	34		
526		9796	Equus caballus	48	45	54	55	6	10
527		9798	Equus przewalskii		1		1		
528		9823	Sus scrofa	113	53	115	53	2	
529		9825	Sus scrofa domesticus		5		5		
530		9844	Lama glama	1		1			
531		9860	Cervus elaphus	2		6		4	
532		9864	Cervus canadensis nelsoni	5		5			
533		9874	Odocoileus virginianus	2		2			
534		9913	Bos taurus	1300	831	1320	844	20	13
535		9925	Capra hircus	11		11			
536		9940	Ovis aries	92	17	95	17	3	
537		9978	Ochotona princeps		1		1		
538		9986	Oryctolagus cuniculus	59	10	66	10	7	
539		10029	Cricetulus griseus	1		9		8	
540		10036	Mesocricetus auratus	56		58		2	
541		10090	Mus musculus	670	16890	697	20365	27	3475
542		10092	Mus musculus domesticus		12		12		
543	X	10095	Mus sp.			1		1	
544		10114	Rattus	11		11			
545		10116	Rattus norvegicus	242	30447	267	33167	25	2720
547		10118	Rattus sp.		1		1		
548		10141	Cavia porcellus	37	75	37	79		4
549		10243	Cowpox virus		25		25		
550		10244	Monkeypox virus	5	2	5	2		
551		10245	Vaccinia virus	11	495	11	547		52

552		10247	Vaccinia virus WR 65-16		4		4		
553		10248	Vaccinia virus LC16M8		5		5		
554		10249	Vaccinia virus Copenhagen	31	829	31	846		17
555		10251	Vaccinia virus IHD-J	1		1			
556		10253	Vaccinia virus Tian Tan		21		21		
557		10254	Vaccinia virus WR	31	6689	31	6689		
558		10255	Variola virus		248		248		
559		10261	Fowlpox virus		7		7		
560		10263	Fowlpox virus isolate HP-438/Munich		1		1		
561		10273	Myxoma virus		4		4		
562		10276	Swinepox virus		2		2		
563		10292	Herpesviridae		1		1		
564		10298	Human alphaherpesvirus 1	154	178	181	181	27	3
565		10299	Human alphaherpesvirus 1 strain 17	44	46	44	46		
566		10301	Human alphaherpesvirus 1 strain Angelotti		4		4		
567		10303	Human alphaherpesvirus 1 strain HFEM	2		2			
568		10304	Human alphaherpesvirus 1 strain F	17	5	17	5		
569		10306	Human alphaherpesvirus 1 strain KOS	17	4	17	4		
570		10308	Human alphaherpesvirus 1 strain Patton	3		3			
571		10309	Human alphaherpesvirus 1 strain SC16	5	2	5	2		
572		10310	Human alphaherpesvirus 2	224	226	295	226	71	
573		10312	Human herpesvirus 2 strain 186	1	1	1	1		
574		10313	Human herpesvirus 2 strain 333	2	5	2	5		
575		10315	Human herpesvirus 2 strain HG52		31		31		
576		10317	Cercopithecine alphaherpesvirus 2		1		1		
577		10320	Bovine alphaherpesvirus 1	5	40	5	40		
578		10323	Bovine herpesvirus type 1.1 (strain Cooper)	9	17	9	17		
579		10324	Bovine herpesvirus type 1.1 (strain P8-2)	1		1			
580		10325	Macacine alphaherpesvirus 1	1		1			
581		10326	Equid alphaherpesvirus 1	7	218	7	218		
582		10331	Equid alphaherpesvirus 4	6		6			
583		10335	Human alphaherpesvirus 3	10	127	10	127		
584		10338	Human herpesvirus 3 strain Dumas		29		29		
585		10345	Suid alphaherpesvirus 1	6	2	7	2	1	
586		10349	Suid herpesvirus 1 (strain NIA-3)	4		4			
587		10359	Human betaherpesvirus 5	118	538	119	613	1	75
588		10360	Human herpesvirus 5 strain AD169	233	417	233	432		15
589		10363	Human herpesvirus 5 strain Towne	5	26	94	26	89	
590		10366	Murid betaherpesvirus 1	2	64	2	64		
591		10367	Murine cytomegalovirus (strain Smith)		32		32		
593		10369	Human herpesvirus 6 (strain GS)	2		2			
594		10370	Human herpesvirus 6 (strain Uganda-1102)	1	2	2	4	1	2
595		10372	Human betaherpesvirus 7	2	4	2	4		
596		10373	Macaca mulatta cytomegalovirus		76		76		
597		10376	Human gammaherpesvirus 4	2316	612	2324	632	8	20
598		10377	Human herpesvirus 4 strain B95-8	171	354	181	355	10	1
599		10378	Human herpesvirus 4 strain RAJI	1		1			
600		10381	Saimiriine gammaherpesvirus 2		3		3		
601		10390	Gallid alphaherpesvirus 2		1		1		
602		10407	Hepatitis B virus	265	643	267	645	2	2
603		10408	Hepatitis B virus subtype adw2	82	61	82	61		
604		10409	Hepatitis B virus adr4		13		13		
605		10410	Hepatitis B virus adw/991	2	2	2	2		
606		10411	Hepatitis B virus alpha1		24		24		
607		10412	Hepatitis B virus adw/Indonesia/PIDW420		3		3		
608		10414	Hepatitis B virus LSH/chimpanzee		2		2		
609		10415	Hepatitis B virus adw/Okinawa/PODW282		5		5		
610		10418	Hepatitis B virus subtype ayw	57	185	57	185		
611		10419	Hepatitis B virus subtype adyw	2	45	4	45	2	
612		10430	Woodchuck hepatitis virus 1	3		3			
613		10433	Woodchuck hepatitis virus 8		34		34		
614		10479	Thermoproteus tenax virus 1	1		1			
615		10497	African swine fever virus	1		5		4	
616		10498	African swine fever virus BA71V	46		46			
617		10515	Human adenovirus 2	28	8	28	16		8
618		10519	Human adenovirus 7	4		4			

619		10521	Human adenovirus 14	4		4			
620		10524	Human adenovirus 41	1		1			
621		10529	Human adenovirus 31		7		7		
622		10530	Murine adenovirus 1	1	2	1	2		
623		10533	Human adenovirus 1		1		1		
624		10541	Human adenovirus 11		12		12		
625		10560	Bovine papillomavirus type 2	15		15			
626		10562	Bovine papillomavirus type 4	10	3	10	3		
627		10566	Human papillomavirus	3	1	3	1		
628		10573	Human papillomavirus type 13	1	1	1	1		
630		10580	Human papillomavirus type 11	9	43	9	43		
631		10583	Human papillomavirus type 1a	8	15	8	15		
632		10585	Human papillomavirus type 31	13	7	13	7		
633		10586	Human papillomavirus type 33	6	9	6	9		
634		10587	Human papillomavirus type 35	1	1	1	1		
635		10588	Human papillomavirus type 39	1	1	1	1		
636		10589	Human papillomavirus type 41		1		1		
637		10592	Human papillomavirus type 44		1		1		
638		10593	Human papillomavirus type 45	2	9	2	9		
639		10595	Human papillomavirus type 51	1	1	1	1		
640		10596	Human papillomavirus type 56	1	5	1	5		
641		10598	Human papillomavirus type 58	49	32	49	34		2
642		10600	Human papillomavirus type 6b	11	29	11	29		
643		10611	Human papillomavirus type 30	1		1			
644		10614	Human papillomavirus 3		3		3		
645		10615	Human papillomavirus type 40	1	1	1	1		
646		10617	Human papillomavirus 4		4		4		
647		10618	Human papillomavirus type 52	1	36	1	36		
648		10620	Human papillomavirus type 7	1	3	1	3		
649		10623	Kappapapillomavirus 2	5	7	5	7		
650		10631	BK virus strain AS		1		1		
651		10632	JC polyomavirus	7	78	9	78	2	
652		10636	Murine polyomavirus strain A2		3		3		
653		10638	Kilham polyomavirus		1		1		
654		10658	Salmonella virus PRD1	2		2			
655		10665	Escherichia virus T4	10	20	10	20		
656		10710	Escherichia virus Lambda		6		6		
657		10754	Salmonella virus P22	5		5			
658		10760	Enterobacteria phage T7	1		1			
659		10783	Aleutian mink disease parvovirus (STRAIN G)	3		3			
660		10786	Feline panleukopenia virus		4		4		
661		10788	Canine parvovirus	23	20	23	20		
662		10790	Canine parvovirus strain CPV-D CORNELL 320	1		1			
663		10791	Canine parvovirus strain N	47		47			
664		10793	Mink enteritis virus strain Abashiri	1		1			
665		10796	Porcine parvovirus	40		40			
666		10798	Human parvovirus B19	93	44	93	44		
667		10804	Adeno-associated virus - 2	42	153	42	153		
668		10847	Escherichia virus phiX174	1		1			
669		10863	Enterobacteria phage f1	1	1	1	1		
670		10864	Enterobacteria phage fd	7	1	7	1		
671		10879	Pseudomonas virus phi6	7		7			
672		10884	Mammalian orthoreovirus 1 Lang	1		3		2	
673		10886	Mammalian orthoreovirus 3 Dearing	1		1			
674		10891	Reovirus sp.		2		2		
675		10900	Bluetongue virus (serotype 10 / American isolate)	3		3			
676		10903	Bluetongue virus 17	4		4			
677		10904	Bluetongue virus (serotype 1 / isolate Australia)	7		7			
678		10906	Bluetongue virus 10	3		3			
679		10915	Porcine rotavirus serotype 5/strain OSU	1		1			
680		10917	Porcine rotavirus strain Gottfried	2		2			
681		10919	Porcine rotavirus strain YM	2	1	2	1		
682		10923	Simian rotavirus A/SA11	8	5	8	5		
683		10927	Bovine rotavirus	9	1	9	1		
684		10933	Bovine rotavirus strain RF	12	7	12	7		
685		10934	Bovine rotavirus strain UK/G6		1		1		

686		10941	Human rotavirus A	14	84	14	84		
687		10950	Human rotavirus (SEROTYPE 2 / STRAIN DS1)	1		1			
688		10952	Human rotavirus strain KU	9		9			
689		10957	Human rotavirus strain P	1	4	1	4		
690		10958	Human rotavirus strain RRV	1		1			
691		10960	Human rotavirus G4 strain St. Thomas 3	6		6			
692		10962	Human rotavirus strain WA	10	7	10	7		
693		10995	Infectious bursal disease virus	12		12			
694		10996	Infectious bursal disease virus 52/70		10		10		
695		10997	Infectious bursal disease virus 002-73/AUS	1		1			
696		11002	Infectious pancreatic necrosis virus	1		1			
697		11021	Eastern equine encephalitis virus	42	2	42	2		
698		11022	Eastern equine encephalitis virus (STRAIN VA33[TEN BROECK])		1		1		
699		11029	Ross River virus		1		1		
700		11032	Ross river virus (STRAIN T48)	3		3			
701		11033	Semliki Forest virus	36	5	36	5		
702		11034	Sindbis virus	26		26			
703		11036	Venezuelan equine encephalitis virus	2	1	2	5		4
704		11037	Venezuelan equine encephalitis virus (strain TC-83)	24		24			
705		11038	Venezuelan equine encephalitis virus (strain Trinidad donkey)	15		15			
706		11039	Western equine encephalitis virus		1		1		
707		11041	Rubella virus	81	100	81	100		
708		11043	Rubella virus strain M33	3	11	3	11		
709		11044	Rubella virus vaccine strain RA27/3	2	6	2	6		
710		11045	Rubella virus strain Therien	20	35	20	35		
711		11047	Equine arteritis virus	3		3			
712		11048	Lactate dehydrogenase-elevating virus	14		14			
713		11049	Lelystad virus	66	12	66	12		
714		11053	Dengue virus 1	40	507	51	559	11	52
715		11057	Dengue virus 1 Thailand/AHF 82-80/1980		1		1		
716		11059	Dengue virus 1 Nauru/West Pac/1974	4	50	4	50		
717		11060	Dengue virus 2	178	641	184	713	6	72
718		11062	Dengue virus 2 Malaysia M2	1		1			
719		11064	Dengue virus 2 Jamaica/1409/1983	264	1254	264	1254		
720		11065	Dengue virus 2 Thailand/NGS-C/1944	18	37	20	37	2	
721		11066	Dengue virus 2 Puerto Rico/PR159-S1/1969	32	21	32	21		
722		11067	Dengue virus 2 Tonga/EKB194/1974		3		3		
723		11069	Dengue virus 3	58	578	76	621	18	43
724		11070	Dengue virus 4	50	374	80	429	30	55
725		11072	Japanese encephalitis virus	40	143	49	143	9	
726		11073	Japanese encephalitis virus strain SA-14	6	1	6	1		
727		11075	Japanese encephalitis virus strain JAOARS982	4	4	4	4		
728		11076	Japanese encephalitis virus strain Nakayama	2	2	2	2		
729		11077	Kunjin virus	12	1	12	1		
730		11078	Kunjin virus (STRAIN MRM61C)		4		4		
731		11079	Murray Valley encephalitis virus	21	9	21	9		
732		11080	Saint Louis encephalitis virus	9	1	9	1		
733		11081	St. Louis encephalitis virus (strain MS1-7)	7		7			
734		11082	West Nile virus	51	440	51	442		2
735		11083	Powassan virus		3	1	3	1	
736		11084	Tick-borne encephalitis virus	14	137	14	137		
737		11085	Langat virus		1		1		
738		11087	Tick-borne encephalitis virus (STRAIN SOFJIN)	6		6			
739		11089	Yellow fever virus		1333		1352		19
740		11090	Yellow fever virus 17D		288		288		
741		11092	Kumlinge virus	26		26			
742		11096	Classical swine fever virus	14	4	15	4	1	
743		11098	Classical swine fever virus - Brescia	4		4			
744		11099	Bovine viral diarrhea virus 1	1	12	1	12		
745		11100	Bovine viral diarrhea virus 1-NADL	4	3	4	3		
746		11103	Hepacivirus C	683	1127	696	1129	13	2
747		11104	Hepatitis C virus (isolate 1)	37	256	37	256		
748		11105	Hepatitis C virus (isolate BK)	3	90	3	90		
749		11108	Hepatitis C virus (isolate H)	145	84	145	84		

750		11110	Hepatitis C virus HCT18	1		1			
751		11113	Hepatitis C virus isolate HC-J6	8	3	8	3		
752		11115	Hepatitis C virus isolate HC-J8	1	1	1	1		
753		11116	Hepatitis C virus (isolate Japanese)	6	19	6	19		
754		11120	Infectious bronchitis virus	7	4	10	5	3	1
755		11127	Avian infectious bronchitis virus (strain M41)	4	3	4	3		
756		11128	Bovine coronavirus	7		7			
757		11137	Human coronavirus 229E		2		2		
758		11138	Murine hepatitis virus	3	31	3	31		
759		11142	Murine hepatitis virus strain A59	26	4	26	4		
760		11144	Murine hepatitis virus strain JHM	25	21	25	21		
761		11149	Transmissible gastroenteritis virus	15	1	15	1		
762		11150	Porcine transmissible gastroenteritis coronavirus strain FS772/70	2		2			
763		11151	Porcine transmissible gastroenteritis coronavirus strain Purdue	14		14			
764		11152	Turkey coronavirus	1		1			
765		11169	Mumps virus strain Kilham	1		1			
766		11173	Mumps virus strain SBL-1	6		6			
767		11176	Avian avulavirus 1	14	5	15	5	1	
768		11177	Newcastle disease virus (STRAIN AUSTRALIA-VICTORIA/32)	4		4			
769		11178	Newcastle disease virus strain Beaudette C/45	12		12			
770		11180	Newcastle disease virus strain D26/76	4		4			
771		11186	Newcastle disease virus strain Queensland/66	4		4			
772		11191	Murine respirovirus	63	10	63	10		
773		11194	Sendai virus (strain Enders)	7	11	7	11		
774		11195	Sendai virus (strain Fushimi)		1		1		
775		11196	Sendai virus (strain Harris)	2		2			
776		11198	Sendai virus (Z)		1		1		
777		11214	Human parainfluenza virus 2 (strain Toshiba)	3		3			
778		11215	Bovine respirovirus 3	3	1	3	1		
779		11216	Human respirovirus 3	2		2			
780		11217	Human parainfluenza 3 virus (strain NIH 47885)	8		8			
781		11232	Canine morbillivirus	10	9	14	9	4	
782		11233	Canine distemper virus strain Onderstepoort	6	19	6	34		15
783		11234	Measles morbillivirus	64	39	64	39		
784		11235	Measles virus strain Edmonston	167	210	167	210		
785		11236	Measles virus strain Halle		34		34		
786		11241	Rinderpest morbillivirus	2	3	2	3		
787		11243	Rinderpest virus (strain L)	6		6			
788		11246	Bovine orthopneumovirus	3	2	3	2		
789		11249	Bovine respiratory syncytial virus (strain RB94)	4		4			
790		11250	Human orthopneumovirus	28	206	34	206	6	
791		11251	Human respiratory syncytial virus (subgroup B / strain 18537)	2	1	2	1		
792		11252	Human respiratory syncytial virus (strain RSB642)	2		2			
794		11255	Human respiratory syncytial virus (strain RSB6190)	6		6			
795		11256	Human respiratory syncytial virus (strain RSB6256)	10		11		1	
796		11259	Human respiratory syncytial virus A2	81	136	91	136	10	
797		11260	Human respiratory syncytial virus A strain Long	128	31	128	31		
798		11263	Murine orthopneumovirus		14		14		
799		11269	Marburg marburgvirus	4	95	5	95	1	
800		11276	Vesicular stomatitis virus		10		10		
801		11277	Vesicular stomatitis Indiana virus	9	7	9	7		
802		11278	Vesicular stomatitis Indiana virus strain Glasgow		1		1		
803		11279	Vesicular stomatitis Indiana virus strain Mudd-Summers	1		1			
805		11285	Vesicular stomatitis Indiana virus strain San Juan		1		1		
806		11288	Viral hemorrhagic septicemia virus 07-71	12	1	12	1		
807		11290	Infectious hematopoietic necrosis virus	8		8			
808		11292	Rabies lyssavirus	13	26	13	26		
809		11293	Rabies virus AVO1		3		3		
810		11294	Rabies virus CVS-11	2		2			
811		11295	Rabies virus ERA	10	27	10	27		
812		11296	Rabies virus HEP-FLURY	7	1	7	1		
813		11298	Rabies virus Nishigahara RCEH	1		1			
814		11307	Sonchus yellow net nucleorhabdovirus		1		1		

815		11318	Dhori thogotovirus	1		1			
816		11320	Influenza A virus	70	529	74	533	4	4
818		11384	Influenza A virus (A/chicken/FPV/Weybridge(H7N7))		2		2		
819		11408	Influenza A virus (STRAIN A/EQUINE/NEW MARKET/76)		1		1		
820		11448	Influenza A virus (A/parrot/Ulster/73(H7N1))		1		1		
821		11484	Influenza A virus (A/whale/Maine/1/84(H13N9))	3		3			
822		11520	Influenza B virus	3	6	4	6	1	
823		11521	Influenza B virus (B/Ann Arbor/1/1986)		3		3		
824		11532	Influenza B virus (STRAIN B/HT/84)		1		1		
825		11541	Influenza B virus (B/Oregon/5/80)	16		16			
826	X	11550	Influenza B virus (B/Yamagata/1/73)				3		3
827		11552	Influenza C virus		1		1		
828		11553	Influenza C virus (C/Ann Arbor/1/50)	9		16		7	
829		11577	La Crosse virus	2	1	2	1		
830		11578	La Crosse virus L74		2		2		
831		11583	HoJo virus		1		1		
832		11588	Rift Valley fever virus	5	27	5	27		
833		11589	Rift valley fever virus (STRAIN ZH-548 M12)		2		2		
834		11602	Hantaan virus 76-118	14	68	14	132		64
835		11605	Puumala virus Hallnas B1		1		1		
836		11607	Sapporo rat virus	1	4	1	4		
837		11610	Seoul virus SR11	1		1			
838		11618	Arenavirus		2		2		
839		11620	Lassa mammarenavirus	13	670	13	670		
840		11621	Lassa virus GA391		54		54		
841		11622	Lassa virus Josiah	10	409	10	409		
842		11623	Lymphocytic choriomeningitis mammarenavirus	5	654	5	654		
843		11624	Lymphocytic choriomeningitis virus (strain Armstrong)		1158		1158		
844		11625	Lymphocytic choriomeningitis virus (strain Pasteur)		5		5		
845		11626	Lymphocytic choriomeningitis virus (strain Traub)		3		3		
846		11627	Lymphocytic choriomeningitis virus (strain WE)		69		69		
847		11628	Machupo mammarenavirus		800	1	800	1	
848		11629	Mopeia mammarenavirus		14		14		
849		11631	Tacaribe mammarenavirus		106		106		
850		11636	Reticuloendotheliosis virus	2	5	2	5		
851		11660	Caprine arthritis encephalitis virus	14	1	14	1		
852		11661	Caprine arthritis encephalitis virus strain Cork	9		9			
853		11662	Caprine arthritis encephalitis virus G63	6		6			
854		11665	Equine infectious anemia virus	93	112	93	112		
855		11670	Equine infectious anemia virus (CLONE 1369)		1		1		
856		11671	Equine infectious anemia virus (STRAIN WSU5)		19		19		
857		11673	Feline immunodeficiency virus		28		30		2
858		11674	Feline immunodeficiency virus (isolate Petaluma)	2	3	2	4		1
859	X	11675	Feline immunodeficiency virus (isolate San Diego)				1		1
860		11676	Human immunodeficiency virus 1	196	481	236	499	40	18
861		11678	Human immunodeficiency virus type 1 BH10	2	26	2	27		1
862		11679	Human immunodeficiency virus type 1 (CLONE 12)		7		7		
864		11682	Human immunodeficiency virus type 1 (BH5 ISOLATE)		1		1		
865		11683	Human immunodeficiency virus type 1 (Z2/CDC-Z34 ISOLATE)		1		1		
867		11685	HIV-1 M:B_ARV2/SF2	1	44	1	44		
868		11686	Human immunodeficiency virus type 1 (BRU ISOLATE)	1	4	1	4		
869		11687	Human immunodeficiency virus type 1 (CDC-451 ISOLATE)		3		3		
870		11688	Human immunodeficiency virus type 1 (JRCSF ISOLATE)	3	37	4	37	1	
871		11689	Human immunodeficiency virus type 1 (ELI ISOLATE)		7		7		
872		11690	Human immunodeficiency virus type 1 (SF33 ISOLATE)		3		3		
873		11691	Human immunodeficiency virus type 1 (SF162 ISOLATE)	2	1	2	1		
874		11694	Human immunodeficiency virus type 1 (JH3 ISOLATE)		4		4		
875		11695	Human immunodeficiency virus type 1 (NDK ISOLATE)		8		8		
876		11696	HIV-1 M:B_MN	10	23	11	27	1	4
877		11697	Human immunodeficiency virus type 1 (MAL ISOLATE)		8		8		
878		11698	Human immunodeficiency virus type 1 (NEW YORK-5 ISOLATE)	1	2	2	2	1	

879		11699	Human immunodeficiency virus type 1 (OYI ISOLATE)		3		3		
880		11701	Human immunodeficiency virus type 1 (RF/HAT ISOLATE)	1	19	1	19		
881		11703	Human immunodeficiency virus type 1 (STRAIN UGANDAN / ISOLATE U455)		15		15		
882		11704	Human immunodeficiency virus type 1 (MFA ISOLATE)		2		2		
883		11705	Human immunodeficiency virus type 1 (WMJ2 ISOLATE)		1		1		
884		11706	HIV-1 M:B_HXB2R	13	14	13	17		3
885		11708	Human immunodeficiency virus type 1 (ZAIRE 6 ISOLATE)		1		1		
886		11709	Human immunodeficiency virus 2	1	7	1	8		1
887		11711	Simian immunodeficiency virus - mac		1		1		
888		11713	Human immunodeficiency virus type 2 (ISOLATE D194)		1		1		
889		11714	Human immunodeficiency virus type 2 (ISOLATE BEN)		12		12		
890		11715	Human immunodeficiency virus type 2 (ISOLATE CAM2)		2		2		
891		11716	Human immunodeficiency virus type 2 (ISOLATE D205,7)		2		2		
892		11717	Human immunodeficiency virus type 2 (ISOLATE GHANA-1)		7		7		
893		11718	Human immunodeficiency virus type 2 (ISOLATE SBLISY)		2		2		
894		11720	Human immunodeficiency virus type 2 (ISOLATE ROD)		2		2		
895		11723	Simian immunodeficiency virus		221		238		17
896		11730	Simian immunodeficiency virus (AGM3 ISOLATE)		1		1		
899		11733	Simian immunodeficiency virus (MM142-83 ISOLATE)		102		102		
900		11734	Simian immunodeficiency virus (MM251 ISOLATE)		1		1		
901		11735	Simian immunodeficiency virus - mac K6W		125		125		
902		11736	Simian immunodeficiency virus (K78 ISOLATE)		29		29		
903		11737	Simian immunodeficiency virus (F236/SMH4 ISOLATE) (SOOTY MANGABEY)		17		17		
904		11738	Simian immunodeficiency virus (PBJ/BC13 ISOLATE) (SOOTY MANGABEY)		2		2		
905		11742	Visna lentivirus (strain 1514)	1		1			
906		11743	Visna lentivirus (strain 1514 / clone LV1-1KS1)	4		4			
907		11746	Jaagsiekte sheep retrovirus	1		1			
908		11757	Mouse mammary tumor virus		12		12		
909		11764	Baboon endogenous virus strain M7	1		1			
910		11769	Feline leukemia virus strain A/Glasgow-1	6		6			
911		11780	Snyder-Theilen feline sarcoma virus	1		1			
912		11786	Murine leukemia virus	1	23	1	23		
913		11790	AKT8 murine leukemia virus	1		1			
914		11791	AKR (endogenous) murine leukemia virus		12		12		
915		11795	Friend murine leukemia virus	6	53	6	53		
916		11801	Moloney murine leukemia virus		5		5		
917		11812	Murine sarcoma virus 3611	4		4			
918		11824	Gardner-Arnstein feline leukemia oncovirus B	13		13			
919		11827	Human endogenous retrovirus	1	1	1	1		
920		11861	Avian erythroblastosis virus	1		1			
921		11864	Avian leukosis virus	2		4		2	
922		11886	Rous sarcoma virus	4	4	4	4		
923		11901	Bovine leukemia virus	108	40	108	40		
925		11908	Human T-cell leukemia virus type I	234	280	236	280	2	
926		11909	Human T-lymphotropic virus 2	63	2	63	2		
927		11926	Human T-cell lymphotrophic virus type 1 (strain ATK)	30	118	30	118		
928		11927	Human T-cell lymphotrophic virus type 1 (Caribbean isolate)		6		6		
929		11928	Human T-cell lymphotrophic virus type 1 (isolate MT-2)	1		1			
930		11942	Simian retrovirus 1	1		1			
931		11966	Aids-associated retrovirus		2		2		
932		11976	Rabbit hemorrhagic disease virus	4		4			
933		11978	Feline calicivirus	4		4	1		1
934		11980	Feline calicivirus strain Japanese F4	6		6			
935		11981	Feline calicivirus strain F9	2		2			
936		11983	Norwalk virus	4	1	4	1		
937		11984	Southampton virus	1		1			

938		12022	Enterobacteria phage MS2	1		1			
939		12060	Echovirus E9	1		1			
940		12063	Human parechovirus 1	7		7			
941		12064	Enterovirus E	13		13			
942		12065	Bovine enterovirus strain VG-5-27	6		6			
943		12066	Coxsackievirus	1		1			
944		12067	Coxsackievirus A9	30		30			
945		12071	Coxsackievirus B1	12		12			
946		12072	Coxsackievirus B3	7	15	7	15		
947		12073	Coxsackievirus B4	17	51	17	51		
948		12075	Swine vesicular disease virus	1		1			
949		12076	Swine vesicular disease virus (STRAIN H/3 '76)	5		5			
950		12077	Swine vesicular disease virus (STRAIN UKG/27/72)	3		3			
951		12078	Echovirus E11	1		1			
952		12080	Human poliovirus 1	6	1	6	1		
953		12081	Human poliovirus 1 Mahoney	62	31	62	31		
954		12082	Human poliovirus 1 strain Sabin	7		7			
955		12086	Human poliovirus 3	5	2	5	2		
956		12088	Poliovirus type 3 (strains P3/LEON/37 AND P3/LEON 12A[1]B)	4	15	4	15		
957		12092	Hepatovirus A	26	22	26	22		
958		12098	Human hepatitis A virus Hu/Australia/HM175/1976	86	83	86	83		
959		12104	Encephalomyocarditis virus		1		1		
960		12107	Mengo virus	5	13	5	13		
961		12110	Foot-and-mouth disease virus	24	5	25	5	1	
962		12111	Foot-and-mouth disease virus - type A	3	5	3	6		1
963		12112	Foot-and-mouth disease virus (strain A10-61)	8		8			
964		12113	Foot-and-mouth disease virus (strain A5)	3		3			
965		12114	Foot-and-mouth disease virus (strain A12)	21	1	21	1		
966		12115	Foot-and-mouth disease virus (strain A24 Cruzeiro)	17	32	17	32		
967		12116	Foot-and-mouth disease virus - type C	6	26	6	26		
968		12117	Foot-and-mouth disease virus (strain C3 Indaial)	2		2			
969		12118	Foot-and-mouth disease virus - type O	43	5	44	8	1	3
970		12120	Foot-and-mouth disease virus (strain C1-Santa Pau)	1		1			
971		12121	Foot-and-mouth disease virus C1	1	4	1	4		
972		12123	Foot-and-mouth disease virus - type SAT 3		1		1		
973		12124	Theiler's encephalomyelitis virus		18	1	18	1	
974		12125	Theiler's encephalomyelitis virus (STRAIN BEAN 8386)	16	52	16	52		
975		12126	Theiler's encephalomyelitis virus (STRAIN DA)	3	2	3	2		
976		12130	Human rhinovirus A2	11		11			
977		12131	Rhinovirus B14	15	1	15	1		
978		12132	Human rhinovirus A89	3		3			
979		12134	Human rhinovirus 1A		19		19		
980		12146	Tomato bushy stunt virus (STRAIN BS-3)	3		3			
981		12161	Beet yellows virus	5		5			
982		12162	Citrus tristeza virus	8		8			
983		12211	Plum pox virus	1		1			
984		12213	Plum pox virus isolate NAT		1		1		
985		12216	Potato virus Y	2		2			
986		12219	Potato virus Y strain N	1		1			
987		12220	Potato virus Y strain O	7		7			
988		12232	Zucchini yellow mosaic virus	1		1			
989		12242	Tobacco mosaic virus	36	13	36	13		
990		12243	Tobacco mosaic virus (vulgare)	1		1			
991		12246	Tobacco mosaic virus strain Dahlemense	2		2			
992		12260	Bean pod mottle virus	2		2			
993		12264	Cowpea mosaic virus		1		1		
994		12305	Cucumber mosaic virus	1		1			
995		12455	Borna disease virus	8	4	8	4		
996		12461	Hepatitis E virus	151	76	153	76	2	
997		12475	Hepatitis delta virus	56	7	56	19		12
998		12509	Human herpesvirus 4 type 2	2	10	2	10		
999		12557	Seoul virus 80-39		3		3		
1000		12618	Chicken anemia virus	3		3			
1001		12637	Dengue virus	39	553	51	553	12	
1002		12639	Duck hepatitis B virus	262	20	262	20		

1003		12643	Ectromelia virus		6		6		
1004		12663	Feline coronavirus		1		1		
1005		12701	Human astrovirus 2	1		2		1	
1006		12750	Visna/maedi virus EV1	1		1			
1007		12760	Murine hepatitis virus strain 4		5		5		
1008		12814	Respiratory syncytial virus				2		2
1009		12870	Variola major virus		17		17		
1010		13101	Juniperus ashei	13		13			
1011		13187	Parietaria officinalis	2		2			
1012		13286	Theromyzon tessulatum	1		1			
1013		13373	Burkholderia mallei	1	49	1	49		
1014		13415	Chamaecyparis obtusa	5	68	5	68		
1015		13451	Corylus avellana	27	57	27	57		
1016		13469	Cupressus sempervirens		8		8		
1017		13557	Hapalemur griseus		1		1		
1018		13616	Monodelphis domestica	1	4	1	4		
1019		13618	Myrmecia pilosula	2		2			
1020		13687	Sphingomonas	1	4	1	4		
1022		15368	Brachypodium distachyon	1		1			
1023		15957	Phleum pratense	63	1129	64	1143	1	14
1024		16719	Juglans nigra	1		1			
1025		27990	Plasmodium vivax-like sp.	3	1	3	1		
1026		28038	Lactobacillus curvatus		1		1		
1027		28080	Campylobacter upsaliensis	3		3			
1028		28108	Alteromonas macleodii		1		1		
1029		28130	Prevotella disiens		1		1		
1031		28227	Mycoplasma penetrans	40		40			
1032		28276	Human adenovirus 15	1		1			
1033	X	28280	Human adenovirus E4			1		1	
1034		28282	Human adenovirus 12	11	3	11	3		
1035		28284	Human adenovirus 40	2	1	2	1		
1036		28285	Human adenovirus 5	25	184	26	185	1	1
1037		28295	Porcine epidemic diarrhea virus	2		5		3	
1038		28300	Heron hepatitis B virus		1		1		
1039		28314	Aleutian mink disease virus	9		10		1	
1040		28327	Murine rotavirus		3		3		
1041		28344	Porcine reproductive and respiratory syndrome virus	87	53	87	95		42
1042		28375	Soil-borne wheat mosaic virus	1		1			
1043		28448	Komagataeibacter xylinus		1		1		
1044		28450	Burkholderia pseudomallei	14	9	14	9		
1045		28479	Phalaris aquatica		12		12		
1046		28869	Ovine respiratory syncytial virus	1		1			
1047		28871	Taterapox virus		4		4		
1048		28873	Camelpox virus		2		2		
1049	X	28875	Rotavirus A			1		1	
1050		28901	Salmonella enterica		57		141		84
1051		28903	Mycoplasma bovis	21		21			
1052		28909	Cynodon dactylon	27	48	27	48		
1053		29176	Neospora caninum	2	17	2	17		
1054		29271	Dasheen mosaic virus	1		1			
1055		29292	Pyrococcus abyssi		1		1		
1056		29320	Paenarthrobacter nicotinovorans	1		1			
1057		29339	Bacillus thuringiensis serovar kurstaki	3		3			
1058		29362	Ruminiclostridium papyrosolvens		1		1		
1059		29371	Ruminiclostridium cellobioparum subsp. termitidis	1		1			
1060		29388	Staphylococcus capitis	1		1			
1061		29430	Acinetobacter haemolyticus	1		1			
1062		29442	Pseudomonas tolaasii		1		1		
1063		29447	Xanthomonas albilineans		1		1		
1064		29459	Brucella melitensis	17	94	17	94		
1065		29461	Brucella suis	1	8	1	8		
1066		29477	Salmonella enterica subsp. enterica serovar Essen	1		1			
1067		29491	Aeromonas salmonicida subsp. salmonicida		1		1		
1068		29507	Leptospira kirschneri	1		1			
1069		29518	Borreliella afzelii	5	1	5	1		
1070		29519	Borreliella garinii	6	29	6	29		

1071		29661	Anthoxanthum odoratum		3		3		
1072		29679	Holcus lanatus	14	3	14	3		
1073		29715	Ambrosia psilostachya		10		10		
1074		29760	Vitis vinifera	1		1			
1075		29780	Mangifera indica	1		1			
1076		29918	Cladosporium herbarum		18		18		
1077		29960	Penaeus indicus	2		2			
1078		30069	Anopheles stephensi	1		1			
1080	X	30538	Vicugna pacos			1		1	
1081		31271	Plasmodium chabaudi chabaudi		3		3		
1082		31273	Plasmodium vivax strain Belem	6	31	6	31		
1083		31276	Perkinsus marinus		1		1		
1084		31285	Trypanosoma brucei gambiense	2		2			
1085		31286	Trypanosoma brucei rhodesiense		9	1	9	1	
1086		31330	Ephydatia fluviatilis		1		1		
1087		31512	Hepatitis B virus adr/mutant		1		1		
1088		31525	Human herpesvirus 4 strain CAO		1		1		
1089		31531	Vaccinia virus L-IPV		8		8		
1090		31545	Human adenovirus D8	1	1	1	1		
1091		31552	Human papillomavirus type 6	12	4	12	4		
1092		31560	Infectious bursal disease virus E	1		1			
1093		31569	Human rotavirus (serotype 2 / strain RV-5)	1		1			
1094		31604	Small ruminant morbillivirus	13	31	13	31		
1095		31608	Simian virus 5 (isolate canine/CPI+)	1		1			
1096		31611	Bovine respiratory syncytial virus (strain 391-2)	3		3			
1097		31615	Tacaribe virus strain V5		1		1		
1098		31616	Tacaribe virus strain V7		1		1		
1099		31621	Four Corners hantavirus	2	8	2	8		
1100		31631	Human coronavirus OC43		1		1		
1101		31634	Dengue virus 2 Thailand/16681/84	32	62	32	62		
1102		31635	Dengue virus 2 16681-PDK53	4	32	4	32		
1103		31641	Yellow fever virus 1899/81		36		36		
1104		31644	Hepatitis C virus HCV-KF	1	1	1	1		
1105		31645	Hepatitis C virus (isolate Taiwan)	3	15	3	15		
1106		31646	Hepatitis C virus subtype 1a	201	399	202	399	1	
1107		31647	Hepatitis C virus subtype 1b	608	293	608	293		
1108		31649	Hepatitis C virus subtype 2a	80	22	80	22		
1109		31650	Hepatitis C virus subtype 2b	103	4	103	4		
1110		31653	Hepatitis C virus subtype 4a	1	1	1	1		
1111		31654	Hepatitis C virus subtype 5a	1	1	1	1		
1112		31655	Hepatitis C virus subtype 6a		1		1		
1113		31678	Human immunodeficiency virus type 1 (WMJ1 isolate)		16		16		
1115		31682	Simian immunodeficiency virus - mac1A11		18		18		
1116		31683	Simian immunodeficiency virus - stm		7		7		
1117		31684	Simian immunodeficiency virus (isolate AGM / clone GRI-1)		2		2		
1119		31704	Coxsackievirus A16	4		4			
1120		31708	Human rhinovirus A16		30		30		
1121		31715	Bean-pod mottle virus (strain Kentucky G7)	9	1	9	1		
1122		31721	Beet necrotic yellow vein virus	10		10			
1123		31767	Hepatitis E virus (strain Burma)	160		160			
1124		31768	Hepatitis E virus (strain Mexico)	31		31			
1125		32008	Burkholderia	1		1			
1126		32019	Campylobacter fetus subsp. fetus	3		3			
1127		32022	Campylobacter jejuni subsp. jejuni	2		2			
1128		32025	Helicobacter hepaticus		1		1		
1129		32049	Synechococcus sp. PCC 7002		1		1		
1130		32201	Carya illinoinensis	19		19			
1131		32278	Metapenaeus ensis	1	6	1	6		
1132		32603	Human betaherpesvirus 6A	2	7	2	7		
1133		32604	Human betaherpesvirus 6B	2	42	2	1394		1352
1134		32605	Buffalopox virus		1		1		
1135		32606	Rabbitpox virus		2		2		
1136		32614	Convict Creek 107 virus	1	3	1	3		
1137		32644	unidentified		16381		22056		5675
1138		33127	Parietaria judaica	65	2	65	2		

1139		33178	Aspergillus terreus	2		2			
1140		33703	Suid herpesvirus 1 strain Kaplan	4		4			
1141		33706	Caviid betaherpesvirus 2	3	3	3	3		
1142		33708	Murid gammaherpesvirus 4	1	53	1	53		
1143		33717	Bluetongue virus (serotype 13 / isolate USA)	2		2			
1144		33718	Bluetongue virus (serotype 17 / isolate USA)	4		4			
1145		33727	Marburg virus - Musoke, Kenya, 1980	3	84	3	84		
1146		33728	Lake Victoria marburgvirus - Popp	2	15	2	15		
1147		33734	Feline infectious peritonitis virus (strain 79-1146)	15	14	15	14		
1148		33741	Dengue virus 1 Singapore/S275/1990		245		245		
1149		33745	Hepatitis C virus genotype 4		2	1	10	1	8
1150		33746	Hepatitis C virus genotype 5		2		2		
1151		33747	Simian T-lymphotropic virus 1		14		14		
1152		33758	Echovirus		1		1		
1153		33892	Mycobacterium tuberculosis variant bovis BCG	12	146	12	146		
1154		33934	Anoxybacillus flavithermus		1		1		
1155		33990	Rickettsia bellii	1		1			
1156		34054	Yersinia enterocolitica (type O:8)		1		1		
1157		34245	Zinnia violacea		1		1		
1158		34631	Rhipicephalus appendiculatus	1		1			
1159		34632	Rhipicephalus sanguineus	1		1			
1160		34828	Eulemur mongoz	1		1			
1161		34862	Otospermophilus beecheyi		1		1		
1162		35241	Lactococcus phage Tuc2009	1		1			
1163		35258	Lambdapapillomavirus 2		25		25		
1164		35269	Woodchuck hepatitis virus	4	6	4	6		
1165		35275	Murine endogenous retrovirus		13		13		
1166		35288	Grapevine virus A	12		12			
1167		35292	Foot-and-mouth disease virus - type SAT 2	1	1	1	1		
1168		35297	Striped jack nervous necrosis virus	1		1			
1169		35305	California encephalitis virus		1		1		
1170		35327	Bluetongue virus 1	4		4			
1171		35329	Bluetongue virus 11	6		6			
1172		35330	Bluetongue virus 13	1		1			
1173		35331	Bluetongue virus 15	7		7			
1174		35336	Rotavirus G4		1		1		
1175		35345	Lactococcus phage TP901-1	3		3			
1176		35670	Naja naja	3		3			
1177		35725	Macrophomina phaseolina		1		1		
1178		35788	Rickettsia africae		1		1		
1179		35791	Rickettsia massiliae		1		1		
1180		35793	Rickettsia sibirica		4		4		
1181		35795	Ehrlichia muris	2	3	2	3		
1182		36329	Plasmodium falciparum 3D7	181	270	182	270	1	
1183		36351	Human herpesvirus 6 strain Z29	1	96	1	146		50
1184		36352	Human herpesvirus 4 type 1	4	14	4	14		
1185		36372	Feline immunodeficiency virus (strain UK8)		1		1		
1186		36374	Visna/maedi virus EV1 KV1772	2		2			
1187		36375	Human immunodeficiency virus type 1 (KB-1 isolate)		2		2		
1188		36382	Venezuelan equine encephalitis virus (strain 3880)		1		1		
1189		36386	Louping ill virus (strain 31)	1		1			
1190		36409	Rinderpest virus (strain RBOK)	33	5	33	5		
1191		36412	Human parainfluenza 1 virus (strains A1426 / 86-315 / 62M-753)		1		1		
1192		36418	Influenza A virus (A/chicken/Brescia/1902(H7N7))		1		1		
1193		36420	H1N1 swine influenza virus		13		13		
1194		36421	African horse sickness virus 4	42	4	42	4		
1195		36439	Bovine rotavirus strain NCDV/G6	1		1			
1196		36470	Streptococcus sp. 'group A'	21		21			
1197		36596	Prunus armeniaca	4		4			
1198		36809	Mycobacteroides abscessus		19		19		
1199		36826	Clostridium botulinum A	46		46			
1200		36827	Clostridium botulinum B	29		29			
1201		36829	Clostridium botulinum D	2		2			
1202		36830	Clostridium botulinum E	3	3	3	3		
1203		36831	Clostridium botulinum F	3		3			

1204		36855	Brucella canis		4		4		
1205		36911	Clavispora lusitaniae	1		1			
1206		36936	Lepidoglyphus destructor	5	10	5	10		
1208		37111	Human papillomavirus 28		1		1		
1209		37112	Human papillomavirus 29		1		1		
1210		37115	Human papillomavirus type 59	2	1	2	1		
1211		37120	Human papillomavirus type 67	2		2			
1212		37121	Human papillomavirus type 69		1		1		
1213		37124	Chikungunya virus	53	3	78	10	25	7
1214		37128	Potato mop-top virus	8		8			
1215		37132	Rabies virus Ontario fox	3		3			
1216		37137	Simian rotavirus A/SA11-both	20	2	20	2		
1217		37207	Rio Segundo hantavirus	1		1			
1218		37296	Human gammaherpesvirus 8	26	488	26	488		
1219		37325	Muscovy duck parvovirus	11		11			
1220	X	37326	Nocardia brasiliensis			6		6	
1221		37329	Nocardia farcinica		1		1		
1222		37347	Tupaia belangeri		1		1		
1223		37546	Glossina morsitans morsitans	2		2			
1225		37762	Escherichia coli B	1	1	1	1		
1226		38020	marmosets	3		3			
1227		38033	Chaetomium globosum	1		1			
1228		38171	Avian reovirus strain S1133	5		5			
1229		38251	Goose parvovirus	9		9			
1230		38323	Bartonella henselae	1		1			
1231		38832	Micromonas		1		1		
1232		38873	Fraxinus excelsior		3		3		
1233		38973	Influenza A virus (A/Memphis/4/1973(H3N2))		1		1		
1234		39002	Puumala virus sotkamo/v-2969/81	196		196			
1235		39015	Human T-cell lymphotropic virus type 1 (african isolate)		2		2		
1236		39054	Enterovirus A71	91	1	111	1	20	
1238		39113	Hepatitis GB virus B		4		4		
1239		39152	Methanococcus maripaludis	1		1			
1240		39414	Plantago lanceolata		2		2		
1241		39442	Mus musculus musculus		1		1		
1242		39457	Human papillomavirus type 70		1		1		
1244		39803	Escherichia virus Qbeta		2		2		
1245		39947	Oryza sativa Japonica Group	5	1	5	1		
1246		40051	Bluetongue virus	9		12	1	3	1
1247		40214	Acinetobacter johnsonii		1		1		
1248		40271	Hepatitis C virus genotype 2	41	6	41	6		
1249		40674	Mammalia	6		6			
1250		40697	Blomia tropicalis	19	6	19	6		
1251		41514	Salmonella enterica subsp. arizonae serovar 62:z4,z23:-		4		4		
1252		41856	Hepatitis C virus genotype 1	2	163	2	177		14
1253		41857	Influenza A virus H3N2	2	49	2	49		
1254		41953	Pseudo-nitzschia	1		1			
1255		42097	Isla Vista hantavirus	1	2	1	2		
1256		42182	Hepatitis C virus genotype 6		7		7		
1257		42229	Prunus avium	3	1	3	1		
1258		42345	Phoenix dactylifera		3		3		
1259		42358	Hantavirus Monongahela-3		5		5		
1260		42764	Oliveros mammarenavirus		2		2		
1262		42782	Coxsackievirus A20	1		1			
1263	X	42789	Enterovirus D68			1		1	
1264		42792	Hepatitis C virus subtype 3g	1		1			
1265		42862	Rickettsia felis		1		1		
1266		42897	Shigella flexneri 2a	35		35			
1267		43304	Mycolicibacterium peregrinum	2		2			
1268		43765	Corynebacterium amycolatum		1		1		
1269		43767	Rhodococcus hoagii	18	2	18	3		1
1270	X	43852	Toxicodendron			1	1	1	1
1271		44026	Sepik virus		1		1		
1272		44088	Canarypox virus		8		8		
1273		44104	Vibrio cholerae 569B	37		37			
1274		44271	Leishmania chagasi	3		3			

1275		44275	Leptospira interrogans serovar Copenhageni	2		2			
1276		44276	Leptospira interrogans serovar Pomona	2	3	2	3		
1277		44561	Murine type C retrovirus		1		1		
1278		44689	Dictyostelium discoideum	1	1	1	1		
1279		44755	New York hantavirus		2		2		
1280		45029	Bluetongue virus 16	3		3			
1281		45201	Mannheimia haemolytica serotype 1	82		82			
1282		45219	Guanarito mammarenavirus		842		842		
1283		45240	Human papillomavirus type 68		1		1		
1284		45409	Feline immunodeficiency virus (isolate wo)	3		3			
1285		45410	Hepatitis B virus adw4/Brazil/isolate w4b		12		12		
1286		45455	Macacine gammaherpesvirus 4		27		27		
1287		45582	[Candida] saitoana	1		1			
1288		45617	Human endogenous retrovirus K	14		14			
1289		45659	Human adenovirus B3	29	2	29	2		
1291		46015	Autographa californica nucleopolyhedrovirus		1		1		
1292		46221	Porcine circovirus	1	49	1	49		
1293		46242	Spodoptera litura nucleopolyhedrovirus		2		2		
1294		46245	Drosophila pseudoobscura pseudoobscura	1		1			
1295		46290	Foot-and-mouth disease virus C3	4	1	4	1		
1296		46457	Cycloclasticus oligotrophus		1		1		
1297	X	46506	Bacteroides stercoris				1		1
1298		46771	Simian virus 12	1		1			
1299		46835	Fasciola gigantica	2		3		1	
1300		46919	Whitewater Arroyo mammarenavirus		349		349		
1301		46920	Rio Mamore hantavirus	1	1	1	1		
1302		46921	Human adenovirus D13	1		1			
1303		46941	Human adenovirus 46	1		1			
1305		47929	Macacine betaherpesvirus 3		99		99		
1306		48409	Salmonella enterica subsp. enterica serovar Virchow		1		1		
1307		48483	Reclinomonas americana		1		1		
1308		48935	Novosphingobium aromaticivorans		1		1		
1309		49011	Hesperocyparis arizonica	2	6	2	6		
1311		50557	Insecta	7		7			
1312		51031	Necator americanus	17		17			
1313		51033	Human papillomavirus type 73		1		1		
1314		51240	Juglans regia	34	19	34	19		
1315		53179	Porcine rubulavirus	3		3			
1316		53182	Feline foamy virus	7		7			
1317		53258	Variola minor virus		93		93		
1318		53751	Echinacea purpurea	1		1			
1319		54290	GB virus C	16		16			
1320		54315	Bovine viral diarrhea virus 2	1		1			
1321		54388	Salmonella enterica subsp. enterica serovar Paratyphi A		1		1		
1322		54390	Micrurus corallinus	123		123			
1323		55097	Mobala mammarenavirus	1		1			
1325		55429	Megathura crenulata	1		1			
1326		55513	Pistacia vera		6		6		
1327		55532	Influenza A virus (A/swine/Quebec/1192/1986(H1))		1		1		
1328		55601	Vibrio anguillarum	1		1			
1329		55635	Inula helenium		1		1		
1330		55951	Grapevine leafroll-associated virus 3	1		1			
1331		56636	Aeropyrum pernix	3	2	3	2		
1332		57068	Acanthisitta chloris		1		1		
1333		57266	Plasmodium falciparum 7G8	42	52	42	52		
1334		57270	Plasmodium falciparum Palo Alto/Uganda	38		38			
1335		57278	Human herpesvirus 7 strain JI		1		1		
1337		57372	Mycoplasma suis	3		3			
1338		57482	European bat 1 lyssavirus		1		1		
1339		57486	Mus musculus molossinus		1		1		
1340		57667	Simian-Human immunodeficiency virus	1		1			
1341		57678	Leptospira interrogans serovar Lai	10	10	10	10		
1342		58024	Spermatophyta	3	1	4	1	1	
1343		58216	Loxosceles gaucho	1		1			
1344		58217	Loxosceles laeta	2		2			
1345		58218	Loxosceles intermedia	83		83			

1346		59201	Salmonella enterica subsp. enterica		18		18		
1347		59202	Salmonella enterica subsp. salamae		1		1		
1348		59203	Salmonella enterica subsp. arizonae		1		1		
1349		59205	Salmonella enterica subsp. houtenae		1		1		
1350		59375	Influenza A virus (A/South Carolina/1/1918(H1N1))	8	1	8	1		
1351		59538	Pantholops hodgsonii		1		1		
1352		59729	Taeniopygia guttata		1		1		
1353		59799	Angomonas deanei		2		2		
1354		60189	Rhipicephalus decoloratus	5		5			
1356		60552	Burkholderia vietnamiensis		2		2		
1357		60876	Pixuna virus		1		1		
1358		60879	Cabassou virus		1		1		
1359		60893	Desulfobacca acetoxidans		1		1		
1360		61466	Gnathostoma binucleatum	10		10			
1361		61673	Porcine endogenous retrovirus	2	11	2	11		
1362		62319	Halococcus saccharolyticus		1		1		
1363		62330	Fagopyrum tataricum	5		5			
1364		62446	Influenza A virus (A/Argentina/3779/94(H3N2))		1		1		
1365		62478	Influenza A virus (A/Kitakyushu/93(H3N2))		1		1		
1366		62488	Influenza A virus (A/Nanchang/58/1993(H3N2))		1		1		
1367		62496	Influenza A virus (A/New_York/17/94(H3N2))		1		1		
1368		62503	Influenza A virus (A/Ohio/3/95(H3N2))		1		1		
1369		62512	Influenza A virus (A/Shangdong/5/94(H3N2))		1		1		
1370		62541	Influenza A virus (A/Christchurch/2/1988(H3N2))		1		1		
1371		62549	Influenza A virus (A/Fukuoka/C29/1985(H3N2))	5		5			
1372		62559	Influenza A virus (A/Los Angeles/1987(H3N2))	5		5			
1373		62564	Influenza A virus (A/New_York/15/94(H3N2))		1		1		
1374		62575	Influenza A virus (A/Sichuan/2/1987(H3N2))		5		5		
1375		62596	Influenza A virus (A/USSR/26/1985(H3N2))		1		1		
1377		62977	Acinetobacter sp. ADP1		2		2		
1378		63106	Influenza A virus (A/Wuhan/359/1995(H3N2))	5		5			
1379		63221	Homo sapiens neanderthalensis		1		1		
1380		63330	Hendra henipavirus	9	2	9	2		
1381		63363	Aquifex aeolicus	2	3	2	3		
1382		63421	Swine hepatitis E virus	7		10		3	
1383		63673	Turbo cornutus	2		2			
1384		63737	Nostoc punctiforme PCC 73102		2		2		
1385		63746	Hepatitis C virus (isolate H77)	137	208	152	208	15	
1386		64284	Saboya virus		1		1		
1387		64289	Carey Island virus		2		2		
1388		64293	Tembusu virus	2		2	10		10
1389		64320	Zika virus	15	131	53	193	38	62
1390		64382	Human Endogenous Retrovirus IDDMK1,2-22	3		3			
1391		64495	Rhizopus oryzae	4	1	4	1		
1392		65690	AK7 murine leukemia virus		1		1		
1393		65699	Neisseria meningitidis serogroup A	5		5			
1394		65743	Blackcurrant reversion virus	2		2			
1395		66692	Bacillus clausii KSM-K16		1		1		
1396		68621	Classical swine fever virus strain Riems		5		5		
1397		68887	Torque teno virus	5	94	5	94		
1398		68909	Deinococcus geothermalis	1		1			
1399		69008	Juniperus oxycedrus		3		3		
1400		69153	Human enterovirus 71 (strain BRCR)	1		1			
1401		69156	Murine cytomegalovirus (strain K181)	2	14	2	14		
1402		69245	Lechiguanas virus		9		9		
1404		69247	Oran virus		2		2		
1405		69248	Pergamino virus		1		1		
1406		70146	Measles virus strain Edmonston-B	2	78	2	78		
1407		70149	Measles virus strain Edmonston-Zagreb	1		1			
1408		70175	Androctonus australis hector	24		24			
1409		70203	Vibrio virus fs1		1		1		
1410		70865	Murine rotavirus EDIM		27		27		
1411		71238	Pseudomonas sp. G-179		1		1		
1412		71421	Haemophilus influenzae Rd KW20		3		3		
1415		72132	Rotavirus G1	1	1	1	1		
1416		72539	Physalis mottle virus	2		2			

1417		72556	Achromobacter piechaudii	1		1			
1418		72590	Salmonella sp. 'group B'	6		6			
1419	X	72664	Eutrema salsugineum			2		2	
1420		73036	Rotavirus G3		1		1		
1421		73239	Plasmodium yoelii yoelii	22	42	22	42		
1422		73482	Foot-and-mouth disease virus (strain O1)	18	1	18	1		
1423		73484	Human immunodeficiency virus type 2 (isolate KR)		3		3		
1424		74138	Pseudomonas sp. DJ-12		1		1		
1425		74368	Sinonatrix annularis	1		1			
1426		74537	Vladivostok virus	1		1			
1428		74722	Stachybotrys chartarum	11		11			
1429		74942	Hantavirus CRF355		1		1		
1431		75922	Mycolicibacterium tusciae		2		2		
1433		76777	Malassezia sympodialis	1		1			
1434		76832	Myroides odoratimimus		1		1		
1435		76869	Pseudomonas putida GB-1		1		1		
1437		77009	Hordeum vulgare subsp. spontaneum		2		2		
1438		78245	Xanthobacter autotrophicus Py2		1		1		
1439		79692	Human respiratory syncytial virus B1	1	25	1	25		
1440		79695	Influenza A virus (A/Memphis/1/71H-A/Bellamy/42N)		1		1		
1441		79889	Bovine herpesvirus type 1.1	2		2			
1442		79923	Clonorchis sinensis	2	1	2	1		
1443		80365	Laminaria digitata	2		2			
1444		80859	Streptomyces ribosidificus		1		1		
1445		80956	Pomacentrus moluccensis		1		1		
1446		81475	Frateuria aurantia	1		1			
1447		81847	Trichophyton quinckeanum	1		1			
1448	X	81985	Capsella rubella			1		1	
1449		82300	Adeno-associated virus - 5	9		9			
1450		82372	Influenza A virus (A/Sydney/05/97-like(H3N2))		1		1		
1451		82470	Bovine viral diarrhea virus strain Oregon C24V	5	3	5	3		
1452		82639	Coxsackievirus B2	2		2			
1453		82659	Sapporo virus-Manchester		1		1		
1454		82823	Bovine respiratory syncytial virus strain lelystad	1		1			
1455		82824	Bovine respiratory syncytial virus strain snook	1	75	1	75		
1456		82830	Epstein-barr virus strain ag876	1	1	14	1	13	
1457		82831	Equid herpesvirus type 2 strain 86/87	1		1			
1459		83192	Topografov hantavirus	1		1			
1460		83206	Influenza A virus (A/swine/Scotland/410440/94(H1N2))		5		5		
1461		83262	Mycobacteroides immunogenum		5		5		
1462		83331	Mycobacterium tuberculosis CDC1551		42		42		
1463		83332	Mycobacterium tuberculosis H37Rv	61	876	62	964	1	88
1464		83333	Escherichia coli K-12	23	19	28	19	5	
1465		83334	Escherichia coli O157:H7		123		123		
1466		83455	Myxococcus stipitatus		1		1		
1467		83554	Chlamydia psittaci	78	2	86	2	8	
1468		83555	Chlamydia abortus	3		12		9	
1469	X	83556	Chlamydia felis			3		3	
1470	X	83557	Chlamydia caviae			6		6	
1471		83558	Chlamydia pneumoniae	67	24	84	24	17	
1472	X	83559	Chlamydia suis			4		4	
1473		83560	Chlamydia muridarum		3	12	3	12	
1474		83810	Thosea asigna virus		1		1		
1475		85106	Adeno-associated virus - 1		11		11		
1476		85223	Laurus nobilis		1		1		
1477		85552	Scylla paramamosain	7		7			
1478		85569	Salmonella enterica subsp. enterica serovar Typhimurium str. DT104	1		1			
1479		85698	Achromobacter xylosoxidans	1		1			
1480		85708	Porcine circovirus 2	31		33	1	2	1
1481		85709	Porcine circovirus type 2-B	2		6		4	
1482		85777	Agelas mauritiana		1		1		
1483		85962	Helicobacter pylori 26695	13	10	40	10	27	
1484		85963	Helicobacter pylori J99		53		53		
1485	X	85991	Chlamydia pecorum			116		116	
1486		86107	Coxsackievirus A6	1		1			

1487		86600	Discosoma sp.		1		1		
1488		86782	Amur virus		35		35		
1490		87883	Burkholderia multivorans	1	2	1	2		
1491		88036	Selaginella moellendorffii		1		1		
1492	X	88085	Lachesis stenophrys			13		13	
1493		88086	Protobothrops elegans	7		7			
1494		88087	Protobothrops flavoviridis	3		3			
1495		88103	Influenza A virus (A/Hong Kong/532/1997(H5N1))		1		1		
1496		88104	Influenza A virus (A/Hong Kong/483/1997(H5N1))	3	10	3	10		
1497		88776	Influenza A virus (A/Brevig Mission/1/1918(H1N1))		1		1		
1498		89169	Influenza A virus (A/Chicken/Pennsylvania/13552-1/98 (H7N2NSB))	1		1			
1499		89172	Influenza A virus (A/quail/Arkansas/16309-7/94 (H7N3NSA))	1		1			
1501		89462	Bubalus bubalis	7	1	7	1		
1503		90370	Salmonella enterica subsp. enterica serovar Typhi	15	111	15	111		
1504		90371	Salmonella enterica subsp. enterica serovar Typhimurium	15	76	16	76	1	
1505		91465	Pseudomonas sp. MIS38		1		1		
1506		92652	Shrimp white spot syndrome virus	3		3			
1507		93061	Staphylococcus aureus subsp. aureus NCTC 8325	5	1	5	1		
1508		93062	Staphylococcus aureus subsp. aureus COL	17	1	17	1		
1509		93621	Heteropneustes fossilis		1		1		
1510		93678	TTV-like mini virus		1		1		
1511		93838	Influenza A virus (A/goose/Guangdong/1/1996(H5N1))	1	9	1	9		
1512		94432	Human rotavirus MP409	1	1	1	1		
1513		94966	Bluetongue virus 12	15		15			
1514		94967	Bluetongue virus 4	7		7			
1516		95486	Burkholderia cenocepacia	1	1	1	1		
1517		95602	Eriocheir sinensis	10		10			
1518		95888	Influenza A virus (A/mallard duck/PA/10218/84(H5N2))	8		8			
1520		97348	Influenza A virus (A/Chicken/Hong Kong/G23/97(H9N2))		1		1		
1521		97353	Influenza A virus (A/Chicken/Hong Kong/739/94(H9N2))		1		1		
1522		97477	Acetomicrobium mobile		1		1		
1523		98360	Salmonella enterica subsp. enterica serovar Dublin		2		2		
1524		99287	Salmonella enterica subsp. enterica serovar Typhimurium str. LT2		77		77		
1525		99586	Echis ocellatus	5		5			
1526		99875	Leishmania donovani donovani	1		1			
1527		99883	Tetraodon nigroviridis		2		2		
1528		100226	Streptomyces coelicolor A3(2)		1	1	1	1	
1529		100835	Influenza A virus (A/Chicken/Hong Kong/258/97 (H5N1))	1		1			
1530		101350	Porcine rotavirus strain A253	2		2			
1531		102617	Helicobacter pylori SS1	3	3	3	3		
1532		102793	H5N1 subtype	21	36	27	36	6	
1533		102796	H9N2 subtype	1		1			
1534		102862	Proteus penneri	1		1			
1535		103448	Pleistophora sp. LS		1		1		
1536		103903	Coxsackievirus B3 (strain Nancy)	13	30	13	30		
1537		103905	Coxsackievirus B4 (strain E2)	7	41	7	41		
1538		103906	Coxsackievirus B4 (strain JVB / Benschoten / New York/51)		76		76		
1539		103920	Guinea pig cytomegalovirus (strain 22122 / ATCC VR682) (GPCMV)	1		1			
1540		103929	Rabies virus strain Pasteur vaccin	2	1	2	1		
1541		103930	Rhesus cytomegalovirus strain 68-1		18		18		
1542		104102	Acetobacter tropicalis		1		1		
1543		105751	Aeromonas bestiarum		1		1		
1544		106820	Hepatitis B virus subtype adr	23	25	23	25		
1545		106821	Hepatitis B virus subtype adw	17	75	17	75		
1546		107404	Influenza B virus (B/Beijing/184/93)		1		1		
1547		107406	Influenza B virus (B/Chiba/447/98)		1		1		
1548		107493	Influenza A virus (A/Cordoba/3278/96(H3N2))		1		1		
1549		107558	Influenza A virus (A/France/75/97(H3N2))		1		1		
1550		107819	Clostridium perfringens D	44		44			
1551		108098	Human mastadenovirus B	1		1			
1552		110195	Foot-and-mouth disease virus - type Asia 1	10	3	10	3		

1553		112509	Hordeum vulgare subsp. vulgare		18		18		
1554		114727	H1N1 subtype	12	44	15	44	3	
1555		114729	H2N2 subtype		1		1		
1556		114742	Pythium insidiosum	2		2			
1557	X	115711	Chlamydia pneumoniae AR39			1		1	
1558		115713	Chlamydia pneumoniae CWL029		48		48		
1559		117125	Cucumber mosaic virus (strain Pepo)	1		1			
1560		117204	African horse sickness virus 3	21		21			
1561		119210	H3N2 subtype	4	23	5	23	1	
1562		119211	H3N8 subtype	1		1			
1563		119218	H7N7 subtype		1		1		
1564		119602	Streptococcus dysgalactiae subsp. equisimilis	21		21			
1565		119856	Francisella tularensis subsp. tularensis		5		5		
1566		119912	Salmonella enterica subsp. enterica serovar Choleraesuis		3		3		
1567		120505	Baboon cytomegalovirus		1		1		
1568		121224	Pediculus humanus corporis	1		2		1	
1569		121723	Photobacterium sp. SKA34		1		1		
1570		121759	Paracoccidioides brasiliensis	4	16	4	16		
1571		121791	Nipah henipavirus	5		5			
1572		122291	Kappapapillomavirus 1	2		2			
1573		122355	Pseudomonas psychrophila	1		1			
1574		122586	Neisseria meningitidis MC58	17		17			
1575		122928	Norovirus GI	2		2			
1576		122929	Norovirus GII	2		2			
1577		126283	Herpes simplex virus unknown type		1		1		
1578		126793	Plasmodium vivax Sal-1	17		17			
1579		126794	Vaccinia virus Ankara		127		127		
1580		127906	Vibrio cholerae O1	9		9			
1581		127999	Tanacetum parthenium		1		1		
1582		128947	Ebola virus - Gabon (1994-1997)		18		18		
1583		128948	Sudan virus - Boniface, Sudan,1976	2	1	2	1		
1584		128949	Sudan ebolavirus - Maleo (1979)		30		30		
1585		128951	Ebola virus - Zaire (1995)		1		1		
1586		128952	Ebola virus - Mayinga, Zaire, 1976	36	13	36	13		
1587		128982	Influenza A virus (A/Swine/Indiana/9K035/99 (H1N2))		2		2		
1588		128987	Grass carp reovirus		1		1		
1589		128999	Tai Forest virus - Cote d'Ivoire, Cote d'Ivoire, 1994	1	3	1	3		
1590		129000	Ebola virus - Eckron (Zaire, 1976)		12		12		
1591		129003	Reston ebolavirus - Reston	2	27	2	27		
1592		129052	Catelliglobosispora koreensis		1		1		
1593		129138	Pseudomonas amygdali pv. morsprunorum	2		2			
1594		129727	Bovine papular stomatitis virus		2		2		
1595		129875	Human mastadenovirus A		1		1		
1596		129951	Human mastadenovirus C	1	3	1	3		
1597	X	130663	Fowl aviadenovirus 4			3		3	
1598		130760	Influenza A virus (A/Hong Kong/1073/99(H9N2))	1	25	1	25		
1599		130763	Influenza A virus (A/Hong Kong/156/97(H5N1))	2	26	2	26		
1600		132475	Yaba-like disease virus		3		3		
1601		132487	Measles virus strain Schwarz	1	1	1	1		
1602		132504	Influenza A virus (A/X-31(H3N2))	77	189	77	189		
1604		132783	Influenza A virus (A/Netherlands/626/89 (H3N2))		1		1		
1605		132841	Influenza A virus (A/Netherlands/785e/90 (H3N2))		1		1		
1606		132884	Influenza A virus (A/Netherlands/458/98 (H3N2))		1		1		
1607		133704	Porcine circovirus 1	5		5			
1608		134537	Paraburkholderia fungorum	1		1			
1610		135661	Influenza A virus (A/environment/Hong Kong/437-10/99 (H5N1))		1		1		
1611		135720	Neisseria meningitidis serogroup C	3		3			
1612		136371	Umbilicaria papulosa	1		1			
1613		136474	Influenza A virus (A/Swine/Colorado/23619/99(H3N2))		1		1		
1614		136966	SEN virus		7		7		
1615		137578	Influenza A virus (A/England/939/69 x A/PR/8/34)		2		2		
1616		137885	Influenza A virus (A/parakeet/Chiba/1/97(H9N2))		4		4		
1617		137886	Influenza A virus (A/parakeet/Narita/92A/98(H9N2))		2		2		
1618		138948	Enterovirus A	1		1			

1619		138950	Enterovirus C	6	3	6	3		
1623		142948	Influenza A virus (A/ruddy turnstone/Delaware/67/1998(H12N4))		1		1		
1624		144549	Mycolicibacterium fortuitum subsp. fortuitum		1		1		
1625		145262	Methanothermobacter thermautotrophicus		1		1		
1626		145306	Influenza A virus (A/swine/Hong Kong/10/98(H9N2))	5		5			
1627		145307	Influenza A virus (A/swine/Hong Kong/9/98(H9N2))	2		2			
1628		147095	Influenza A virus (A/Swine/Italy/25823/94(H3N2))		2		2		
1629		147272	Paspalum notatum		16		16		
1630		148360	Watermelon mosaic virus 2 (isolate USA)	2		2			
1631		148363	Helicoverpa armigera nucleopolyhedrovirus G4	2		2			
1632		149539	Salmonella enterica subsp. enterica serovar Enteritidis		2	1	2	1	
1633		150080	Norovirus isolates	1		1			
1634		150127	Influenza B virus (B/Osaka/983/97-V3)	1		1			
1635		150340	Vibrio antiquarius		15		15		
1636		150396	Pseudomonas sp. MT-1		1		1		
1637		150846	Enterovirus 5865/sin/000009	2		2			
1638		151250	Kali turgidum		22		22		
1639		152219	Menangle virus	2		2			
1640		152794	Corynebacterium efficiens		5		5		
1641		153969	Influenza A virus (A/Hong Kong/497/97(H3N2))		1		1		
1642		154540	Influenza A virus (A/Kayano/57(H2N2))		1		1		
1643		155017	Anogeissus	1		1			
1644		155091	Secale cereale subsp. afghanicum		2		2		
1645		155218	Influenza A virus (A/Hong Kong/482/97(H5N1))	7	1	7	1		
1646		155220	Influenza A virus (A/Hong Kong/542/97(H5N1))	1		1			
1647		155222	Influenza A virus (A/Hong Kong/488/97(H5N1))		1		1		
1648		155225	Influenza A virus (A/Hong Kong/507/97(H5N1))		5		5		
1649		155226	Influenza A virus (A/Hong Kong/514/97(H5N1))		1		1		
1650		155227	Influenza A virus (A/Hong Kong/516/97(H5N1))		2		2		
1651		155864	Escherichia coli O157:H7 str. EDL933	3	32	4	32	1	
1652		155917	Influenza A virus (A/NWS/33HA-A/tern/Australia/G70C/75NA(H1N9))	1		1			
1653		156230	Karenia brevis	1		1			
1654		156586	Flavobacteria bacterium BBFL7		1		1		
1656	X	157703	Murine polyomavirus strain A3				4		4
1657		157914	Ziziphus mauritiana	4		4			
1658		158306	Influenza A virus (A/swine/Cotes d'Armor/800/00(H1N2))		1		1		
1659		158465	Human calicivirus Hu/NLV/GII/MD145-12/1987/US	1		1			
1660		158474	Bovine viral diarrhea virus strain Trangie Y546	1		1			
1661		158879	Staphylococcus aureus subsp. aureus N315		5		5		
1662		159091	Pseudomonas sp. KIE171		1		1		
1663	X	159449	Streptomyces scabrisporus			1		1	
1664		159471	Influenza A virus (A/eq/Sussex/89/(H3N8))	4		4			
1665		159479	Saaremaa hantavirus		21		21		
1666		160490	Streptococcus pyogenes M1 GAS	13	2	13	2		
1667		160491	Streptococcus pyogenes str. Manfredo	3	35	3	35		
1668		160753	Simian immunodeficiency virus 17E-Fr		2		2		
1669		161502	Influenza A virus (A/swine/Italy/1509-6/97(H1N1))		15		15		
1670		161600	Yellow grouper nervous necrosis virus	1		1			
1671		161727	Foot-and-mouth disease virus A10/Holland	11	14	11	14		
1672		161934	Beta vulgaris	5		5			
1673		162145	Human metapneumovirus	8	130	8	130		
1674		162326	Influenza A virus (A/Hong Kong/1143/99(H3N2))	1		1			
1675		163164	Wolbachia endosymbiont of Drosophila melanogaster		1		1		
1676		164326	Influenza A virus (A/Hong Kong/1131/1998(H1N1))	1	1	1	1		
1677		164756	Mycobacterium sp. MCS		73		73		
1678		164757	Mycobacterium sp. JLS		77		77		
1679		165420	Influenza A virus (A/Turkey/MO/24093/99(H1N2))		4		4		
1680		165512	Influenza A virus (A/goose/Guangdong/3/1997(H5N1))	3	1	3	1		
1682		167758	TTV-like virus DXL1		10		10		
1683		168278	Influenza A virus (A/swine/Finistere/127/99(H3N2))		4		4		
1684		168807	Escherichia coli O127:H6	1		1			
1685		169166	Influenza A virus (A/swine/Italy/1521/98(H1N2))		4		4		
1686		169169	Influenza A virus (A/swine/Cotes d'Armor/1482/1999(H1N1))		1		1		

1687		169173	Choclo virus		3		3		
1689		169963	Listeria monocytogenes EGD-e	5	64	5	64		
1691		170187	Streptococcus pneumoniae TIGR4		2		2		
1692		170325	Canid alphaherpesvirus 1		1		1		
1693		170342	Influenza A virus (A/swine/Italy/1654-1/99(H1N2))		1		1		
1694		170500	H1N9 subtype	1		1			
1695		170525	Measles virus genotype D4	1		1			
1696		170529	Measles virus genotype D7	1		1			
1697		170955	Amur virus Solovey/AP63/1999		2		2		
1698		171101	Streptococcus pneumoniae R6		12	1	12	1	
1699		171264	Measles virus genotype D3	1		1			
1700		171425	Influenza B virus (B/Kobe/87/2001)	1		1			
1701		171929	Anacardium occidentale	64	10	64	10		
1702		172148	Alkhumra hemorrhagic fever virus		4		4		
1703		172149	Influenza A virus (A/swine/Quebec/192/81(H1N1))	1		1			
1704		172851	Avian hepatitis E virus	20		20			
1705		173473	Influenza A virus (A/swine/Hong Kong/2106/98(H9N2))		2		2		
1706		173477	Influenza A virus (A/swine/Hong Kong/3297/98(H9N2))		3		3		
1707		176672	Influenza A virus (A/Duck/Hong Kong/ww461/2000(H5N1))		1		1		
1709		177128	Influenza A virus (A/SW/MN/12883/00(H1N2))		2		2		
1710		177131	Influenza A virus (A/SW/KS/13481-T/00(H1N2))		1		1		
1711		177188	Influenza A virus (A/SW/MN/3227/00(H1N2))		1		1		
1712		177416	Francisella tularensis subsp. tularensis SCHU S4		92		92		
1713		178876	Cryptococcus neoformans var. grubii	1		1			
1714		180454	Anopheles gambiae str. PEST	6	2	6	2		
1715		180498	Jatropha curcas	6		6			
1716		182082	Chlamydia pneumoniae TW-183	7		7			
1717		182781	Influenza A virus (A/Goose/Hong Kong/385.3/2000(H5N1))		1		1		
1718		182785	Mycobacterium tuberculosis subsp. tuberculosis		1		1		
1719		183741	Influenza A virus (A/Chicken/Shanghai/F/98(H9N2))	5		5			
1720		183764	Influenza A virus (A/Puerto Rico/8/34/Mount Sinai(H1N1))	7	100	7	100		
1721		183778	Influenza A virus (A/quail/Hong Kong/SF550/00(H6N1))		2		2		
1722		183783	Influenza A virus (A/duck/Hong Kong/3096/99(H6N2))		2		2		
1723		184816	Influenza B virus (B/Kadoma/122/99)	2		2			
1724		184922	Giardia lamblia ATCC 50803		249		249		
1725		185431	Trypanosoma brucei brucei TREU927		1		1		
1726		185579	Hepatitis E virus type 1	3		3			
1727		185580	Hepatitis E virus type 4	1		1			
1728		185794	Influenza A virus (A/mallard/NZ/1/97(H5N2))		1		1		
1729		185905	Human rhinovirus A34		54		54		
1730		185907	Human rhinovirus A39		1		1		
1731		185949	Sphingomonas aurantiaca		1		1		
1732		186460	Influenza A virus (A/swine/New Jersey/11/1976(H1N1))	1		1			
1733		186536	Ebolavirus	60		61	1	1	1
1734		186538	Zaire ebolavirus	20	870	99	886	79	16
1735		186539	Reston ebolavirus	1	11	1	11		
1736		186540	Sudan ebolavirus	2	280	4	292	2	12
1737		186541	Tai Forest ebolavirus		1		1		
1738		187164	Influenza A virus (A/Swine/Minnesota/55551/2000(H1N2))		1		1		
1739		187410	Yersinia pestis KIM10+		11		11		
1740		187420	Methanothermobacter thermautotrophicus str. Delta H		1		1		
1741		188763	Panine betaherpesvirus 2		4		4		
1742		189518	Leptospira interrogans serovar Lai str. 56601	1		1			
1743		189918	Mycobacterium sp. KMS		69		69		
1744		191090	Influenza A virus (A/Weiss/1943(H1N1))		1		1		
1745		191218	Bacillus anthracis str. A2012		29		29		
1746		192087	Pseudomonas syringae pv. atrofaciens	4		4			
1747		192222	Campylobacter jejuni subsp. jejuni NCTC 11168 = ATCC 700819	10	22	10	22		
1748		192535	Influenza A virus (A/Saudi Arabia/7971/2000(H1N1))		1		1		
1749		192549	Influenza A virus (A/Egypt/96/2002(H1N2))		1		1		
1750		192720	Influenza A virus (A/Saudi Arabia/2581/2001(H1N2))		1		1		
1751		194601	Vipera aspis aspis	3		3			

1752		194958	Porcine endogenous retrovirus A	2		2			
1753		194959	Porcine endogenous retrovirus B	1		1			
1755		195099	Campylobacter jejuni RM1221		13		13		
1756		195102	Clostridium perfringens str. 13		1		1		
1757		195700	Avian rotavirus PO-13	6		6			
1758		196164	Corynebacterium efficiens YS-314		4		4		
1759		196403	Baboon endogenous virus	1	1	1	1		
1760		196462	Influenza A virus (A/chicken/California/1002a/00(H6N2))	1	1	1	1		
1761		196600	Vibrio vulnificus YJ016		75		75		
1762		196620	Staphylococcus aureus subsp. aureus MW2		7		7		
1763		196627	Corynebacterium glutamicum ATCC 13032		14		14		
1764		197575	Haemophilus aegyptius	1		1			
1765		197579	Influenza A virus (A/Chicken/Guangdong/11/97(H9N2))		1		1		
1766		197585	Influenza A virus (A/chicken/Shandong/6/96(H9N2))	1		1			
1767		197589	Influenza A virus (A/Quail/Shanghai/8/96(H9N2))		1		1		
1768		197780	Bluetongue virus 8	2	21	2	21		
1769		198059	Influenza A virus (A/England/627/01(H1N2))		2		2		
1770		198094	Bacillus anthracis str. Ames		2		2		
1771		198214	Shigella flexneri 2a str. 301		4		4		
1772		198215	Shigella flexneri 2a str. 2457T		2		2		
1773		199306	Coccidioides posadasii		9		9		
1774		199310	Escherichia coli CFT073	1	2	1	2		
1775	X	199738	uncultured Chlamydia sp.			2		2	
1776		201444	Aracatuba virus		5		5		
1777		202812	Adeno-associated virus - 7		2		2		
1778		202813	Adeno-associated virus - 8	17	14	17	14		
1779		203119	Hungateiclostridium thermocellum ATCC 27405		1		1		
1780		203124	Trichodesmium erythraeum IMS101		2		2		
1781		203126	Influenza A virus (A/Kamata/14/91(H3N2))	1		1			
1782		203129	Influenza A virus (A/Aichi/2/1994(H3N2))		1		1		
1783		203172	Camelpox virus CMS		28		28		
1784		203173	Camelpox virus M-96		133		133		
1785		203174	Camelpox virus CP1		1		1		
1787		204428	Chlamydiae	16		16			
1788		204711	Theilovirus		10		10		
1789		204722	Brucella suis 1330	1	29	1	29		
1791		205488	Ebola virus sp.		2		2		
1792		205913	Bifidobacterium longum DJO10A		2		2		
1793		205914	Histophilus somni 129PT		2		2		
1794		205920	Ehrlichia chaffeensis str. Arkansas	23		23			
1795		205946	Influenza A virus (A/Chicken/Beijing/1/95(H9N2))		1		1		
1797		206203	Influenza B virus (B/Hong Kong/330/2001)		23		23		
1798		207401	Influenza A virus (A/finch/Canada/NS1301/2001(H3N8))		1		1		
1799		208435	Streptococcus agalactiae 2603V/R	1	2	1	2		
1800		208726	Human hepatitis A virus	4	1	4	1		
1801		208893	Human respiratory syncytial virus A	6	4	8	4	2	
1803		208899	Cupixi mammarenavirus		1		1		
1804		208963	Pseudomonas aeruginosa UCBPP-PA14		23		23		
1805		208964	Pseudomonas aeruginosa PAO1	1	5	2	39	1	34
1806		209261	Salmonella enterica subsp. enterica serovar Typhi str. Ty2		5		16		11
1807		209841	Actinobacillus pleuropneumoniae serovar 7	1		1			
1808		209882	Fusobacterium nucleatum subsp. vincentii ATCC 49256		2		2		
1809		210655	Influenza A virus (A/Duck/Shantou/2144/00(H9N2))		1		1		
1810		210656	Influenza A virus (A/Duck/Shantou/1881/00(H9N2))		1		1		
1811		210659	Influenza A virus (A/Duck/Shantou/2088/01(H9N2))		1		1		
1812		210663	Influenza A virus (A/Duck/Shantou/2134/00(H9N2))		1		1		
1813		211044	Influenza A virus (A/Puerto Rico/8/1934(H1N1))	31	478	33	504	2	26
1814		211110	Streptococcus agalactiae NEM316		1		1		
1815		211882	Leptospira interrogans serovar Australis	2		2			
1816		212042	Anaplasma phagocytophilum str. HZ	21		21			
1817		212045	Bacillus anthracis str. Western North America USA6153		1		1		
1818		212717	Clostridium tetani E88		16		16		
1819		214092	Yersinia pestis CO92	4	22	39	22	35	
1821		214697	Musa acuminata AAA Group	1		1			
1823		214856	Alistipes finegoldii		1		1		

1824		215862	Influenza A virus (A/Chicken/Nanchang/2-220/2001(H3N6))		1		1		
1826		216466	Streptococcus agalactiae serogroup V	1		1			
1827		216495	Streptococcus agalactiae serogroup III	12		12			
1828		216592	Escherichia coli 042	2		2			
1829		216594	Mycobacterium marinum M		29		29		
1830		216597	Salmonella enterica subsp. enterica serovar Typhimurium str. SL1344		2		2		
1831		216600	Streptococcus pneumoniae 23F	6		6			
1832		216877	Influenza A virus (A/quail/Hong Kong/FY298/00(H9N2))		4		4		
1833		216895	Vibrio vulnificus CMCP6		53		53		
1834		217686	Little cherry virus 1		1		1		
1835		217992	Escherichia coli O6		7		7		
1836		219334	Lactobacillus casei subsp. casei ATCC 393	2		2			
1837		220341	Salmonella enterica subsp. enterica serovar Typhi str. CT18		92		92		
1838		220837	Cryptosporidium sp. MNJ-1		1		1		
1839		220977	Influenza A virus (A/England/10/67(H2N2))		1		1		
1840		221012	Influenza A virus (A/Rio/6/69(H3N2))		1		1		
1841		221918	Bovine viral diarrhea virus VEDEVAC	6		6			
1842		221988	[Mannheimia] succiniciproducens MBEL55E		2		2		
1843		222523	Bacillus cereus ATCC 10987		1		1		
1844		223337	Tobacco leaf curl Zimbabwe virus		1		1		
1845		223926	Vibrio parahaemolyticus RIMD 2210633	2	17	2	17		
1846		223931	Influenza A virus (A/Bangkok/10/1983(H1N1))		1		1		
1848		223935	Influenza A virus (A/Okuda/1957(H2N2))	1	9	1	9		
1849		223947	Influenza A virus (A/Hokkaido/20/89(H3N2))		3		3		
1850		223997	Murine norovirus 1	4	1	4	1		
1851		224197	Influenza C virus (C/Nara/1/85)		1		1		
1852		224206	Simian immunodeficiency virus - mon		1		1		
1853		224308	Bacillus subtilis subsp. subtilis str. 168		1		1		
1854		224324	Aquifex aeolicus VF5	1	1	1	1		
1855		224326	Borreliella burgdorferi B31	104	10	107	10	3	
1856		224819	Influenza A virus (A/Nagasaki/76/98(H3N2))		1		1		
1857		224914	Brucella melitensis bv. 1 str. 16M	6	14	6	14		
1858		224964	Influenza B virus (B/Johannesburg/5/99)	1		1			
1859		225071	Influenza A virus (A/Tokyo/1566/98(H3N2))		1		1		
1860		225088	Influenza A virus (A/Kitakyushu/159/93(H3N2))		1		1		
1861		225089	Influenza A virus (A/equine/NewMarket/D64/79(H3N8))		1		1		
1862		226186	Bacteroides thetaiotaomicron VPI-5482		1		1		
1863		226900	Bacillus cereus ATCC 14579		2		2		
1864		227377	Coxiella burnetii RSA 493		13		13		
1865		227859	SARS coronavirus	170	501	170	501		
1866		227984	SARS coronavirus Tor2	171	2205	171	2205		
1867		228330	SARS coronavirus Urbani	24	52	24	52		
1868		228399	Actinobacillus pleuropneumoniae serovar 1 str. 4074	2	1	2	1		
1869		228400	Histophilus somni 2336	1		1			
1871		228407	SARS coronavirus BJ01	64	28	64	28		
1872		228928	Influenza A virus (A/Memphis/31/98(H3N2))	6		6			
1873		229032	Porcine epidemic diarrhea virus CV777	5		5			
1874		229051	Influenza A virus (A/81/HO)		6		6		
1875		229992	SARS coronavirus Frankfurt 1	5	26	5	26		
1876		231428	Avian infectious bronchitis virus (strain Vic S)	11	8	11	8		
1877		231455	Dyella japonica	1		1			
1878		231851	Influenza A virus (A/Hong Kong/1774/99(H3N2))		1		1		
1879		233262	Bovine enteric coronavirus (strain 98TXSF-110-ENT)		1		1		
1880		233412	[Haemophilus] ducreyi 35000HP	1		1			
1881		233413	Mycobacterium tuberculosis variant bovis AF2122/97		50		54		4
1882		234267	Candidatus Solibacter usitatus Ellin6076		2		2		
1883		234603	Sapovirus Mc114		1		1		
1884		234826	Anaplasma marginale str. St. Maries	16	28	16	28		
1885		235279	Helicobacter hepaticus ATCC 51449	2		2			
1886		235455	Adeno-associated virus 9	9		10		1	
1888		237561	Candida albicans SC5314		3		3		
1889		237609	Pseudomonas alkylphenolica		1		1		
1890		237631	Ustilago maydis 521		2		2		

1891		237895	Cryptosporidium hominis		3		3		
1893		240426	Squirrelpox virus		1		1		
1895		242619	Porphyromonas gingivalis W83	4		4			
1896		243160	Burkholderia mallei ATCC 23344		40		40		
1897		243161	Chlamydia muridarum str. Nigg		42		42		
1898		243164	Dehalococcoides mccartyi 195		1		1		
1899		243230	Deinococcus radiodurans R1	1		1			
1900		243232	Methanocaldococcus jannaschii DSM 2661	3	1	3	1		
1901		243243	Mycobacterium avium 104		43		43		
1902		243273	Mycoplasma genitalium G37	8	1	8	1		
1903		243276	Treponema pallidum subsp. pallidum str. Nichols	277	9	277	9		
1904		243277	Vibrio cholerae O1 biovar El Tor str. N16961	4	3	4	3		
1905		244320	Escherichia coli O55:H7		1		1		
1906		244367	Foot-and-mouth disease virus C-S8c1	15	17	15	17		
1907		246196	Mycolicibacterium smegmatis MC2 155		61		61		
1908		246202	Streptococcus sobrinus 6715	4	4	4	4		
1909		246437	Tupaia chinensis	1		1			
1910		246618	Bifidobacterium thermacidophilum	1		1			
1911		246878	Canine parvovirus 2	3		3			
1912		249372	Influenza A virus (A/duck/Hokkaido/13/00(H9N2))	2		2			
1913		251297	Influenza A virus (A/Netherlands/127/03(H7N7))		1		1		
1914		253182	Human Respiratory syncytial virus 9320	1		1			
1915		253682	Influenza A virus (A/swine/Hong Kong/5190/99(H3N2))		3		3		
1916		253686	Influenza A virus (A/swine/Hong Kong/74/02(H3N2))		1		1		
1917		254252	Lactococcus virus P2	2		2			
1918		254355	Small ruminant lentivirus	1		1			
1919		255681	Influenza A virus (A/Yokohama/22/2002(H1N2))		2		2		
1920		255682	Influenza A virus (A/Yokohama/47/2002(H1N2))		1		1		
1921		256045	Influenza A virus (A/swine/Chiai/77-10/2001(H3N1))		1		1		
1922		256080	Influenza B virus (B/Kobe/1/2003)	1		1			
1923		257313	Bordetella pertussis Tohama I		11		11		
1924		257363	Rickettsia typhi str. Wilmington		6		6		
1925		260799	Bacillus anthracis str. Sterne	5	4	5	4		
1926		260806	Influenza A virus (A/FPV/Dutch/1927(H7N7))	1		1			
1927		260965	Cercopithecine herpesvirus 1 (strain E2490)	18		18			
1928		261202	Alto Paraguay hantavirus		3		3		
1929		261204	Itapua hantavirus		10		10		
1930		261594	Bacillus anthracis str. 'Ames Ancestor'		1		1		
1931		261658	Cavenderia fasciculata		1		1		
1932		262307	Measles virus genotype A	4		4			
1933		262316	Mycobacterium avium subsp. paratuberculosis K-10	4	58	4	58		
1934		262698	Brucella abortus bv. 1 str. 9-941		1		1		
1935		262722	Mycoplasma hyopneumoniae 7448	1		1			
1936		262727	Haemophilus influenzae R2846		6		6		
1937		262728	Haemophilus influenzae R2866		2		2		
1938		263683	Bovine herpesvirus 5 strain TX89	2		2			
1939		263815	Pneumocystis murina	3		3			
1940		264510	Influenza A virus (A/chicken/Thailand/LV1NF/2004(H5N1))		1		1		
1942		264635	Acholeplasma granularum	1		1			
1943		264730	Pseudomonas savastanoi pv. phaseolicola 1448A		1		1		
1944		264732	Moorella thermoacetica ATCC 39073		1		1		
1945		265120	Influenza A virus (A/turkey/Italy/214845/2002(H7N3))	1		1			
1946		265619	Ornithodoros erraticus	22		22			
1947		265669	Listeria monocytogenes serotype 4b str. F2365		7		7		
1948		265872	Cowpox virus (Brighton Red)		1		1		
1949		266093	Influenza A virus (A/chicken/Yamaguchi/7/2004(H5N1))	3		3			
1950		266264	Cupriavidus metallidurans CH34		3		3		
1951		266779	Chelativorans sp. BNC1		4		4		
1952		266827	Influenza A virus (A/Thailand/1(KAN-1)/2004(H5N1))	3		4		1	
1953		266834	Sinorhizobium meliloti 1021		3		3		
1954		266940	Kineococcus radiotolerans SRS30216 = ATCC BAA-149		2		2		
1955		267409	Listeria monocytogenes serotype 1/2a str. F6854		3		3		
1956		267410	Listeria monocytogenes serotype 4b str. H7858		25		25		
1957		267671	Leptospira interrogans serovar Copenhageni str. Fiocruz L1-130	11		11			

1958		269482	Burkholderia vietnamiensis G4		9		9		
1959		269484	Ehrlichia canis str. Jake	16		16			
1960		269798	Cytophaga hutchinsonii ATCC 33406		1		1		
1962		269801	Bacillus cereus G9241		41		41		
1963		270338	Human poliovirus 3 strain Sabin	80	1	80	1		
1964		270473	Pneumonia virus of mice J3666		10		10		
1965		270478	Zantedeschia mild mosaic virus	1		1			
1966		270484	Influenza A virus (A/tiger/Thailand/CU-LV/2004(H5N1))		2		2		
1967		270490	Influenza A virus (A/chicken/Nakorn-Patom/Thailand/CU-K3/2004(H5N1))		1		1		
1968		270510	Influenza A virus (A/chicken/Vietnam/HD1/2004(H5N1))		3		3		
1969		270945	Influenza A virus (A/Thailand/4(SP-528)/2004(H5N1))		21		21		
1970		271108	Bombyx mori nucleopolyhedrovirus	2		2			
1971		271848	Burkholderia thailandensis E264		2		2		
1972		272560	Burkholderia pseudomallei K96243	3	735	3	735		
1973		272561	Chlamydia trachomatis D/UW-3/CX		26	1	26	1	
1974		272562	Clostridium acetobutylicum ATCC 824		1		1		
1975		272564	Desulfitobacterium hafniense DCB-2		3		3		
1976		272620	Klebsiella pneumoniae subsp. pneumoniae MGH 78578	28		28			
1978		272624	Legionella pneumophila subsp. pneumophila str. Philadelphia 1	1		1			
1979		272627	Magnetospirillum magnetotacticum MS-1		5		5		
1980		272631	Mycobacterium leprae TN		30		30		
1981		272634	Mycoplasma pneumoniae M129	9		9			
1982		272636	Adeno-associated virus		18		18		
1983		272831	Neisseria meningitidis FAM18	1		1			
1984		272843	Pasteurella multocida subsp. multocida str. Pm70		5		5		
1985		272943	Rhodobacter sphaeroides 2.4.1		1		1		
1986		272944	Rickettsia conorii str. Malish 7		5		5		
1987		272947	Rickettsia prowazekii str. Madrid E		8		8		
1988		272951	Rickettsia sibirica 246		27		27		
1989		273123	Yersinia pseudotuberculosis IP 32953		1		1		
1991		274828	Influenza A virus (A/duck/Fujian/13/2002(H5N1))		1		1		
1992		274829	Influenza A virus (A/duck/Fujian/17/2001(H5N1))		1		1		
1993		278137	Mycolicibacterium gilvum Spyr1		53		53		
1994		279150	Classical swine fever virus 96TD	2		2			
1995		279797	Influenza A virus (A/egret/Hong Kong/757.3/2002(H5N1))		3		3		
1997		279889	Triticum spelta var. arduini		3		3		
1998		280240	Nocardiopsis baichengensis	1		1			
1999		280463	Emiliania huxleyi CCMP1516		1		1		
2000		281310	Haemophilus influenzae 86-028NP	13		13			
2001		281689	Desulfuromonas acetoxidans DSM 684		1		1		
2002		282124	Influenza A virus (A/mallard/Alberta/127/00(H3N8))		1		1		
2003		282458	Staphylococcus aureus subsp. aureus MRSA252	86		86			
2004		283166	Bartonella henselae str. Houston-1		1		1		
2005		283643	Cryptococcus neoformans var. neoformans B-3501A	1	3	1	3		
2006		284168	Influenza A virus (A/Ck/HK/2133.1/2003(H5N1))		1		1		
2007		284177	Influenza A virus (A/Ck/HK/YU22/2002(H5N1))	1		1			
2008		284190	Influenza A virus (A/Ck/Viet Nam/36/2004(H5N1))	1		1			
2009		284195	Influenza A virus (A/Ck/YN/115/2004(H5N1))		1		1		
2010		284202	Influenza A virus (A/Dk/ST/5048/2001(H3N8))	1		1			
2011		284218	Influenza A virus (A/Viet Nam/1203/2004(H5N1))	71	133	73	134	2	1
2012		284672	SARS coronavirus TJF		14		14		
2013		284813	Encephalitozoon cuniculi GB-M1		28		28		
2014		285006	Saccharomyces cerevisiae RM11-1a		2		2		
2015		286239	Influenza A virus (A/red knot/Delaware/2561/1987(H10N5))		1		1		
2016		286542	Soochong virus-2		1		1		
2017		286636	Streptococcus pyogenes MGAS10394		1		1		
2018		286783	Salmonella enterica subsp. enterica serovar Indiana		1		1		
2019		287752	Aurantimonas manganoxydans SI85-9A1		1		1		
2021		289338	Influenza B virus (B/Nanchang/12/98)		1		1		
2022		289365	Human parvovirus 4		3		3		
2024		290512	Prosthecochloris aestuarii DSM 271		1		1		
2025		291592	Influenza A virus (A/crow/Kyoto/53/2004(H5N1))	1		1			
2026		292039	Influenza A virus (A/chicken/HongKong/SF1/03(H9N2))	1		1			

2027		292045	Influenza A virus (A/chicken/HongKong/YU427/03(H9N2))	1		1			
2028		292348	Canine calicivirus (strain 48)	2		2			
2029		292349	Feline calicivirus (strain Urbana)	1		1			
2030		292590	Influenza A virus (A/swine/Ontario/42729A/01(H3N3))	1		1			
2031		292633	Dragon grouper nervous necrosis virus	20		20			
2032		293054	Influenza A virus (A/turkey/Ontario/6213/66(H5N?))	1		1			
2033		293055	Influenza A virus (A/mallard/Ohio/556/1987(H5N9))		1		1		
2034		293090	Influenza A virus (A/Fujian/411/2002(H3N2))		1		1		
2035		293614	Rickettsia akari str. Hartford		1		1		
2036		294381	Entamoeba histolytica HM-1:IMSS		103		103		
2037		295027	Human herpesvirus 5 strain Merlin	2	3	2	3		
2038		295319	Salmonella enterica subsp. enterica serovar Paratyphi A str. ATCC 9150		3		3		
2039		295358	Mycoplasma hyopneumoniae 232	21		21			
2040		298653	Frankia sp. EAN1pec		2		2		
2041		298713	Influenza A virus (A/chicken/Korea/SNU0091/00(H9N2))		1		1		
2042		298716	Influenza A virus (A/chicken/Korea/SNU1035C/00(H9N2))		1		1		
2043		299386	Equine arteritis virus Bucyrus	2		2			
2044		299390	Influenza A virus (A/Viet Nam/HN/2004(H5N1))		6		6		
2045		299730	Influenza A virus (A/chicken/Viet Nam/AG-010/2004(H5N1))		1		1		
2047		300015	Lactate dehydrogenase elevating virus C	1		1			
2048		300016	Lactate dehydrogenase elevating virus Plagemann	1		1			
2049		300021	Candida albicans var. stellatoidea	2		2			
2050		300180	Mopeia Lassa virus reassortant 29		4		4		
2051		300267	Shigella dysenteriae Sd197		5		5		
2052		300268	Shigella boydii Sb227		5		5		
2053		300269	Shigella sonnei Ss046		9		9		
2054		300559	PRRSV VR2332	21		21	7		7
2055	X	300563	PRRSV HB-1(sh)/2002			1		1	
2056		300748	Influenza A virus (A/swine/Korea/S190/2004(H9N2))		3		3		
2057		300749	Influenza A virus (A/swine/Korea/S452/2004(H9N2))		1		1		
2058		300750	Influenza A virus (A/chicken/Korea/S1/2003(H9N2))		1		1		
2059		300852	Thermus thermophilus HB8		1		1		
2060		301448	Streptococcus pyogenes serotype M3	1		1			
2061		301449	Streptococcus pyogenes serotype M5	56	57	56	57		
2062		301450	Streptococcus pyogenes serotype M6	9	7	9	7		
2063		301451	Streptococcus pyogenes serotype M18	1		1			
2064		301452	Streptococcus pyogenes serotype M49	1		1			
2065		301478	Murray valley encephalitis virus (strain MVE-1-51)	11	14	11	14		
2066		301964	CY1014 virus		1		1		
2067		302272	Sendai virus (strain Ohita)	1		1			
2068		303316	Influenza A virus (A/Hatay/2004/(H5N1))	3		3			
2069		304883	Influenza A virus (A/Belfast/53582/2004(H3N?))		2		2		
2070		304895	Catenulispora acidiphila		1		1		
2071		305674	Deerpox virus W-848-83		2		2		
2072		306061	Influenza A virus (A/swine/IDT/Bakum1832/2000(H1N2))		1		1		
2073		306254	Campylobacter coli RM2228		3		3		
2074		306263	Campylobacter lari RM2100		1		1		
2075		306264	Campylobacter upsaliensis RM3195		1		1		
2076		306537	Corynebacterium jeikeium K411		1		1		
2077		307044	West Nile virus strain 385-99	22	12	22	12		
2078		307819	Influenza A virus (A/Jiangsu/38/2004(H3N2))		1		1		
2079		308061	Hantavirus HPR/02-73		1		1		
2080		308159	Araucaria virus		6		6		
2081		310542	Chimpanzee adenovirus	2		2			
2082		311169	Influenza A virus (A/duck/Korea/S10/03(H3N2))		1		1		
2083		311339	Human herpesvirus 5 strain Toledo	9		9			
2084		311695	Influenza A virus (A/New York/124/2001(H3N2))		1		1		
2086		311775	Influenza A virus (A/New York/205/2001(H1N1))		12		12		
2087		313589	Janibacter sp. HTCC2649		1		1		
2088		313596	Robiginitalea biformata HTCC2501		1		1		
2089		313606	Microscilla marina ATCC 23134		1		1		
2090		313627	Bacillus sp. NRRL B-14911		2		2		
2091		314262	Roseobacter sp. MED193		1		1		

2092		314275	Alteromonas mediterranea		1		1		
2093		314278	Nitrococcus mobilis Nb-231		1		1		
2094		314283	Reinekea blandensis MED297		1		1		
2095		314285	Congregibacter litoralis KT71		1		1		
2096		314288	Vibrio alginolyticus 12G01		3		3		
2097		314291	Vibrio splendidus 12B01		2		2		
2098		314292	Photobacterium angustum S14		1		1		
2099		315277	Chlamydia trachomatis A/HAR-13	6	1	6	1		
2100		315456	Rickettsia felis URRWXCal2		7		7		
2101		315730	Bacillus mycoides KBAB4		5		5		
2102		315749	Bacillus cytotoxicus NVH 391-98		3		3		
2103		316056	Rhodopseudomonas palustris BisB18		1		1		
2104		316068	Leadbetterella byssophila		1		1		
2105		316287	Ceratogyrus marshalli	1		1			
2106		316385	Escherichia coli str. K-12 substr. DH10B		3		3		
2107		316401	Escherichia coli ETEC H10407	64	31	64	31		
2108		316407	Escherichia coli str. K-12 substr. W3110		1		1		
2109		317652	Influenza A virus (A/Hong Kong/2/68(H3N2))		4		4		
2110		317655	Sphingopyxis alaskensis RB2256		1		1		
2111		318586	Paracoccus denitrificans PD1222		2		2		
2112		319224	Shewanella putrefaciens CN-32		1		1		
2113		320306	Influenza A virus (A/crested eagle/Belgium/01/2004(H5N1))	2		2			
2114		320372	Burkholderia pseudomallei 1710b		4		4		
2115		320373	Burkholderia pseudomallei 668		10		10		
2116		320374	Burkholderia pseudomallei S13		2		2		
2117		320388	Burkholderia mallei SAVP1		29		29		
2118		320390	Burkholderia mallei GB8 horse 4		1		1		
2119		320483	Anaplasma marginale str. Florida	19	61	19	61		
2120	X	320667	Trichosanthes dioica			1		1	
2121		321314	Salmonella enterica subsp. enterica serovar Choleraesuis str. SC-B67		5		5		
2122		322053	Konjac mosaic virus	1		1			
2123		322564	Influenza A virus (A/tiger/Thailand/CU-T4/04(H5N1))		5		5		
2124		322566	Influenza A virus (A/tiger/Thailand/CU-T6/04(H5N1))		1		1		
2125		322710	Azotobacter vinelandii DJ		2		2		
2127		325240	Shewanella baltica OS155		2		2		
2128		327105	HIV-1 O_ANT70	1		1			
2129		327205	Influenza A virus (A/New York/348/2003(H1N1))		146		149		3
2130		327310	Influenza A virus (A/Kinmen/645/04(H3N2))		1		1		
2131		327311	Influenza A virus (A/Yilan/515/03(H3N2))		1		1		
2132		328670	Banana streak GF virus	4		4			
2133		328671	Banana streak OL virus	4		4			
2135		329389	Hepatitis C virus (isolate Glasgow)	3	4	3	4		
2136		329593	Influenza A virus (A/chicken/Fujian/25/00(H9N2))		6		6		
2137		329854	Bacteroides intestinalis		1		1		
2138		330879	Aspergillus fumigatus Af293		18		18		
2139		331111	Escherichia coli O139:H28 str. E24377A		36		36		
2140		331112	Escherichia coli HS		14		14		
2141		331271	Burkholderia cenocepacia AU 1054		7		7		
2142		331272	Burkholderia cenocepacia HI2424		1		1		
2143	X	331635	Chlamydia pecorum E58			1		1	
2144		331636	Chlamydia psittaci 6BC	1		1			
2145		331978	Burkholderia pseudomallei Pasteur 52237		1		1		
2146		332193	Vaccinia Virus Acambis 3000 MVA		20		20		
2148		332747	Influenza A virus (A/swine/Tennessee/25/1977(H1N1))	1		1			
2149		333278	H7N9 subtype	1	26	3	26	2	
2150		333284	Hepatitis C virus (isolate Con1)	4	3	4	3		
2151		333367	[Clostridium] asparagiforme		1		1		
2152		333668	Theileria parva strain Muguga	14	18	14	19		1
2153		333751	Human papillomavirus type 2		7		7		
2154		333754	Alphapapillomavirus 10	4		4			
2155		333760	Human papillomavirus type 16	335	429	349	463	14	34
2156		333761	Human papillomavirus type 18	26	85	26	104		19
2157		333762	Human papillomavirus type 26		1		1		
2158		333763	Human papillomavirus type 32	1	1	1	1		

2159		333765	Human papillomavirus type 53		1		1		
2160		333849	Enterococcus faecium DO		1		1		
2161		333923	Human papillomavirus 5	1		1			
2162		334203	Mupapillomavirus 1	1	38	1	38		
2163		334380	Orientia tsutsugamushi str. Ikeda		1		1		
2164		334426	Angiostrongylus costaricensis	1	1	1	1		
2166		334590	Influenza A virus (A/Moscow/343/2003(H3N2))		1		1		
2167		334802	Burkholderia mallei FMH		1		1		
2168		334803	Burkholderia mallei JHU		2		2		
2169		335333	Influenza A virus (A/New York/384/2005(H3N2))		64		64		
2170		335337	Influenza A virus (A/New York/388/2005(H3N2))		14		14		
2171		335358	Influenza A virus (A/New York/232/2004(H3N2))		110		110		
2172		335812	Influenza B virus (B/Shanghai/361/2002)	1		1			
2173		336092	Influenza A virus (A/black-headed goose/Qinghai/1/2005(H5N1))	2		2			
2174		336205	Influenza A virus (A/swine/Bakum/5/95(H1N1))		2		2		
2175		336207	Influenza A virus (A/swine/Bakum/1832/2000(H1N2))		3		3		
2176		336238	Influenza A virus (A/Bar-headed Goose/Qinghai/61/05(H5N1))		8		8		
2177		336407	Rickettsia bellii RML369-C		7		7		
2178		336794	Influenza A virus (A/equine/Massachussetts/213/2003(H3N8))		1		1		
2179		336800	Influenza A virus (A/equine/New York/1/1999(H3N8))		3		3		
2180		336982	Mycobacterium tuberculosis F11		24		24		
2181		337042	Alphapapillomavirus 7	9		11		2	
2182		337043	Alphapapillomavirus 4		1		1		
2183		337052	Deltapapillomavirus 4	24		24			
2184		337090	Chlorobium chlorochromatii		1		1		
2185		338188	Bacteroides finegoldii		1		1		
2186		338966	Pelobacter propionicus DSM 2379		3		3		
2187		339670	Burkholderia ambifaria AMMD		4		4		
2188		339854	Bacillus thuringiensis serovar israelensis ATCC 35646		6		6		
2189		340177	Chlorobium chlorochromatii CaD3		1		1		
2190		340184	Escherichia coli B7A		5		5		
2191		340185	Escherichia coli E22		13		13		
2192		340186	Escherichia coli E110019		2		2		
2193		340197	Escherichia coli F11		12		12		
2195		341663	Aspergillus terreus NIH2624	2		2			
2196		341946	Woodchuck hepatitis virus 2	4		4			
2197		341980	Human herpesvirus 3 strain Oka vaccine	3	34	3	62		28
2198		342023	Streptococcus pyogenes serotype M12	3	1	3	1		
2199		342137	Influenza A virus (A/chicken/CA/375TR/2002(H6N2))		1		1		
2200		342145	Influenza A virus (A/turkey/MN/735/79(H6N2))		2		2		
2201		342207	Influenza A virus (A/shorebird/Delaware/141/2002(H9N9))		1		1		
2202		342210	Influenza A virus (A/shorebird/Delaware/275/2001(H9N7))		1		1		
2203		342221	Influenza A virus (A/chicken/Korea/S4/2003(H9N2))		1		1		
2204		342396	Influenza A virus (A/turkey/Canada-Ontario/NS-01839-1/05(H3))		1		1		
2205		342508	Influenza A virus (A/New York/444/2001(H1N1))		24		25		1
2207		342610	Pseudoalteromonas atlantica T6c		1		1		
2208		342613	Streptococcus agalactiae 18RS21	2		2			
2209		342614	Streptococcus agalactiae 515	1		1			
2210		342615	Streptococcus agalactiae H36B	1		1			
2211		342617	Streptococcus agalactiae CJB111	2		2			
2212		343462	Human adenovirus 11p	7		7			
2213		343463	Human adenovirus 11a	1		1			
2214		344598	Influenza A virus (A/whooper swan/Mongolia/6/05(H5N1))		1		1		
2215		344601	Escherichia coli B171		25		25		
2216		344609	Shigella boydii CDC 3083-94		20		20		
2217		344610	Escherichia coli 53638		1		1		
2218		345072	Vibrio cholerae MO10		1		1		
2219		345073	Vibrio cholerae O395		4		4		
2220		345074	Vibrio cholerae RC385		2		2		
2221		345075	Vibrio cholerae V51		3		3		

2222		345076	Vibrio cholerae V52		32		32		
2223		347257	Mycoplasma agalactiae PG2	3		3			
2224		347495	Bacillus cereus F837/76		1		1		
2225		347515	Leishmania major strain Friedlin	29	38	29	38		
2226		348776	Mycobacterium tuberculosis C		177		177		
2227		349101	Rhodobacter sphaeroides ATCC 17029		1		1		
2228		349163	Acidiphilium cryptum JF-5		1		1		
2229		349344	Bat SARS CoV Rp3/2004		1		1		
2230		349746	Yersinia pestis Angola		3		3		
2231		349747	Yersinia pseudotuberculosis IP 31758		9		9		
2232		349966	Yersinia frederiksenii ATCC 33641		2		2		
2233		349967	Yersinia mollaretii ATCC 43969		3		3		
2234		349968	Yersinia bercovieri ATCC 43970		5		5		
2235		350054	Mycolicibacterium gilvum PYR-GCK		64		64		
2236		350058	Mycolicibacterium vanbaalenii PYR-1		55		55		
2237		350702	Burkholderia cenocepacia PC184		1		1		
2238		350703	Pseudomonas aeruginosa 2192		2		2		
2239		350704	Pseudomonas aeruginosa C3719		2		2		
2240		351071	Newcastle disease virus AF2240	1		1			
2241		351073	Mammalian orthoreovirus		1		1		
2242		351277	Influenza A virus (A/Nanchang/0058/1994(H3N2))		1		1		
2243		351581	Francisella tularensis subsp. holarctica FSC200		1		1		
2244		351607	Acidothermus cellulolyticus 11B		2		2		
2245		351627	Caldicellulosiruptor saccharolyticus DSM 8903		1		1		
2246		351745	Shewanella sp. W3-18-1		1		1		
2247		351746	Pseudomonas putida F1		6		6		
2248		352034	Influenza A virus (A/duck/Potsdam/1402-6/1986(H5N2))	1		1			
2249		352348	Influenza A virus (A/chicken/Hong Kong/17/1977(H6N1))		1		1		
2250		352520	Influenza A virus (A/mallard/Alberta/35/1976(H1N1))		6	1	6	1	
2251		352561	Influenza A virus (A/duck/Australia/341/1983(H15N8))		1		1		
2252		352564	Influenza A virus (A/mallard/Astrakhan/263/1982(H14N5))	1		1			
2253		352764	Influenza A virus (A/mallard/Alberta/202/1996(H2N5))	1		1			
2254		352914	Plasmodium yoelii yoelii 17XNL	6	3	6	3		
2255		352963	Influenza A virus (A/California/7/2004(H3N2))		1		1		
2256		353152	Cryptosporidium parvum Iowa II		84		84		
2257		353153	Trypanosoma cruzi strain CL Brener	2058	10	2058	10		
2258		353154	Theileria annulata strain Ankara		4		4		
2259		353253	Influenza A virus (A/duck/Novosibirsk/56/2005(H5N1))	6	2	6	2		
2260		353466	Influenza A virus (A/Canterbury/236/2005(H3N2))		1		1		
2261		354228	Influenza A virus (A/Gf/HK/SSP607/2003(H9N2))		1		1		
2262		354235	Influenza A virus (A/Ck/HK/CSW161/2003(H9N2))		1		1		
2263		354242	Campylobacter jejuni subsp. jejuni 81-176		4		4		
2264		355315	Streptococcus agalactiae serogroup Ia	1		1			
2266		356114	Hepatitis C virus genotype 3	121	17	121	17		
2267		356386	Hepatitis C virus (isolate India)		1		1		
2268		356391	Hepatitis C virus (isolate 6a33)		11		11		
2269		356410	Hepatitis C virus (isolate HC-G9)	2	1	2	1		
2270		356411	Hepatitis C virus JFH-1	8	1	8	5		4
2271		356413	Hepatitis C virus (isolate BEBE1)		14		14		
2272		356415	Hepatitis C virus (isolate NZL1)	1	3	1	3		
2273		356416	Hepatitis C virus (isolate HCV-K3a/650)		21		21		
2274		356417	Hepatitis C virus (isolate JK049)		6		6		
2275		356418	Hepatitis C virus ED43		1		1		
2276		356419	Hepatitis C virus (isolate EUH1480)		5		5		
2277		356421	Hepatitis C virus (isolate Th580)		7		7		
2278		356424	Hepatitis C virus (isolate VN004)		1		1		
2279		356426	Hepatitis C virus subtype 3a	12	105	12	105		
2280		357205	Influenza A virus (A/chicken/Hong Kong/3123.1/2002(H5N1))		1		1		
2281		357208	Influenza A virus (A/Vietnam/CL26/2004(H5N1))		79		79		
2282		357210	Influenza A virus (A/Vietnam/CL100/2004(H5N1))	1		1			
2283		357244	Orientia tsutsugamushi str. Boryong	2	2	2	2		
2284		357348	Burkholderia pseudomallei 1106a		2		2		
2285		357355	Hepatitis C virus (isolate Tr Kj)		3		3		
2286		358708	Shigella dysenteriae 1012		1		1		

2287		358709	Escherichia coli 101-1		5		5		
2288		358769	Classical swine fever virus - Alfort/187	70		70			
2289		358805	Classical swine fever virus - Alfort/Tuebingen	5		5			
2290		358812	Classical swine fever virus - C	2		2			
2291		359391	Brucella abortus 2308		31		31		
2292		359921	Influenza A virus (A/Australian shelduck/Western Australia/1756/1983(H15N2))	1		1			
2293		360095	Bartonella bacilliformis KC583		1		1		
2294		360102	Yersinia pestis Antiqua		36		36		
2295		360112	Campylobacter jejuni subsp. jejuni HB93-13		2		2		
2296		360115	Coxiella burnetii RSA 331		8		8		
2297		360116	Coxiella burnetii 'MSU Goat Q177'		7		7		
2298		360117	Coxiella burnetii Q321		14		14		
2299		360118	Burkholderia pseudomallei 406e		2		2		
2300		360549	Themiste hennahi	1		1			
2301		360910	Bordetella avium 197N		1		1		
2302		362242	Mycobacterium ulcerans Agy99		16		16		
2303		362651	Human immunodeficiency virus type 1 (isolate YU2)	15	21	16	21	1	
2304		362663	Escherichia coli 536		65		65		
2305		363020	Avian leukosis virus HPRS103	1		1			
2306		364106	Escherichia coli UTI89		2		2		
2307		364132	Influenza A virus (A/New York/504/1998(H3N2))		1		1		
2308		365044	Polaromonas naphthalenivorans CJ2		2		2		
2310		365078	Influenza A virus (A/duck/Guangxi/1586/2004(H5N1))		1		1		
2311		365080	Influenza A virus (A/duck/Guangxi/1793/2004(H5N1))		1		1		
2312		365129	Influenza A virus (A/chicken/Vietnam/DT171/2004(H5N1))		1		1		
2314		366394	Sinorhizobium medicae WSM419		1		1		
2316		367120	Influenza A virus (A/Fort Monmouth/1/1947(H1N1))	1		1			
2317		367400	Neembucu hantavirus		5		5		
2318		367830	Staphylococcus aureus subsp. aureus USA300	1		1			
2319		368445	Crocodilepox virus		2		2		
2320		370127	Influenza A virus (A/Victoria/1968(H3N2))		1		1		
2321		370128	Influenza A virus (A/Northern Territory/60/1968(H3N2))		3		3		
2322		370354	Entamoeba dispar SAW760		19		19		
2323		370810	Influenza A virus (A/Anhui/1/2005(H5N1))	6		6			
2324		370811	Influenza A virus (A/Anhui/2/2005(H5N1))	1		1			
2325		370813	Influenza A virus (A/duck/IT/701/2005(H10N7))		1		1		
2326		370830	Hantaan virus Q32		4		4		
2327		371082	Influenza A virus (A/Taiwan/2/2006(H1N1))		7		7		
2328		371094	Chikungunya virus strain S27-African prototype	24		24			
2329		371214	Influenza A virus (A/chicken/Taiwan/0329/01(H6N1))	5		5			
2330		373098	Gambierdiscus toxicus	6		6			
2332		373153	Streptococcus pneumoniae D39		52		61		9
2333		373384	Shigella flexneri 5 str. 8401		23		23		
2334		373665	Yersinia pestis biovar Orientalis str. IP275		1		1		
2335	X	374405	Influenza C virus (C/Yamagata/15/2004)			2		2	
2336		374507	Human rotavirus G9 isolate F45	7		7			
2337		374927	Haemophilus influenzae 22.1-21		3		3		
2338		374928	Haemophilus influenzae PittAA		2		2		
2339		374931	Haemophilus influenzae PittGG		1		1		
2340		374932	Haemophilus influenzae PittHH	1		1			
2341		374933	Haemophilus influenzae PittII		3		3		
2342		375177	Haemophilus influenzae 3655		1		1		
2343		375432	Haemophilus influenzae R3021		2		2		
2344		375450	Yersinia pestis FV-1		2		2		
2345		376619	Francisella tularensis subsp. holarctica LVS	10	291	10	291		
2346		376721	Influenza A virus (A/chicken/Kurgan/05/2005(H5N1))	1		1			
2347		377628	Yersinia pestis Nepal516		135		135		
2348		378131	Influenza A virus (A/Memphis/13/1978(H1N1))		1		1		
2349		378139	Influenza A virus (A/Memphis/1/1978(H1N1))		7		7		
2350		378809	Ravn virus - Ravn, Kenya, 1987	1	32	2	32	1	
2351		378830	Lake Victoria marburgvirus - Angola2005	6	18	6	18		
2353		380210	Influenza A virus (A/England/333/1980(H1N1))	1	1	1	1		
2354		380213	Influenza A virus (A/Taiwan/1/1986(H1N1))		1		1		
2355		380217	Influenza A virus (A/swine/Hong Kong/4/1976(H3N2))		1		1		

2356		380282	Influenza A virus (A/Fort Monmouth/1/1947-mouse adapted(H1N1))		47		47		
2357		380284	Influenza A virus (A/England/268/1996(H7N7))	1	1	1	1		
2358		380285	Influenza A virus (A/turkey/Ireland/1378/1983(H5N8))		1		1		
2359		380299	Influenza A virus (A/turkey/Wisconsin/1968(H5N9))		1		1		
2360		380301	Influenza A virus (A/turkey/Ontario/7732/1966(H5N9))	5	8	5	8		
2361		380330	Influenza A virus (A/goose/Hong Kong/8/1976(H1N1))		2		2		
2362		380332	Influenza A virus (A/swine/Hong Kong/273/1994(H1N1))		1		1		
2363		380337	Influenza A virus (A/equine/Prague/1/1956(H7N7))		1		1		
2364		380339	Influenza A virus (A/equine/Tennessee/5/1986(H3N8))		1		1		
2365		380340	Influenza A virus (A/equine/London/1416/1973(H7N7))	1	1	1	1		
2366		380342	Influenza A virus (A/swine/Iowa/15/1930(H1N1))	1		1			
2367		380343	Influenza A virus (A/ruddy turnstone/New Jersey/47/1985(H4N6))		2		2		
2368		380346	Influenza A virus (A/Wisconsin/3523/1988(H1N1))	2		2			
2370		380836	Influenza A virus (A/chicken/Vietnam/5/2003(H5N1))		1		1		
2371		380842	Influenza A virus (A/duck/Vietnam/15/2003(H5N1))		3		3		
2372		380905	Influenza A virus (A/X-47(H3N2))	3	2	3	2		
2373		380950	Influenza A virus (A/Beijing/32/1992(H3N2))		54		54		
2374		380951	Influenza A virus (A/Hebei/19/1995(H3N2))	1		1			
2375		380960	Influenza A virus (A/Tokyo/3/1967(H2N2))	2		2			
2376		380964	Influenza A virus (A/Texas/36/1991(H1N1))		1		1		
2377		380978	Influenza A virus (A/Wisconsin/4755/1994(H1N1))		5		5		
2378		380979	Influenza A virus (A/Wisconsin/4754/1994(H1N1))		1		1		
2379	X	380982	Influenza A virus (A/WSN(H1N1))				1		1
2380	X	380984	Influenza A virus (A/Leningrad/134/17/1957(H2N2))				2		2
2381		380985	Influenza A virus (A/Chile/1/1983(H1N1))		4		4		
2382		381512	Influenza A virus (A/New Caledonia/20/1999(H1N1))	39	228	39	236		8
2383		381513	Influenza A virus (A/Panama/2007/1999(H3N2))	10	14	10	14		
2384		381516	Influenza A virus (A/USSR/90/1977(H1N1))	11		12		1	
2385		381517	Influenza A virus (A/Udorn/307/1972(H3N2))		5		5		
2386		381518	Influenza A virus (A/Wilson-Smith/1933(H1N1))	1	148	1	149		1
2387		381666	Cupriavidus necator H16		1		1		
2388		382781	Influenza A virus (A/Singapore/1/1957(H2N2))	1	31	1	32		1
2389		382813	Influenza A virus (A/Japan/305+/1957(H2N2))	2		2			
2390		382825	Influenza A virus (A/Philippines/2/1982(H3N2))	1	1	1	1		
2391		382828	Influenza A virus (A/RI/5-/1957(H2N2))		1		1		
2392		382832	Influenza A virus (A/VM113-V1(H1N1))	1		1			
2393		382835	Influenza A virus (A/WSN/1933(H1N1))	6	3	7	3	1	
2394		382842	Influenza A virus (A/swine/29/1937(H1N1))		2		2		
2395		382848	Influenza A virus (A/swine/Hong Kong/126/1982(H3N2))		1		1		
2396		383028	Influenza A virus (A/New York/687/1995(H3N2))	1		1			
2397		383121	Influenza A virus (A/Waikato/7/2000(H3N2))		2		2		
2398		383152	Influenza A virus (A/Wellington/22/2001(H3N2))		1		1		
2399		383231	Influenza A virus (A/Wellington/8/2004(H3N2))		2		2		
2400		383281	Influenza A virus (A/Otago/5/2005(H1N1))		1		1		
2401		383379	Toxoplasma gondii RH	27	23	27	23		
2402		383531	Influenza A virus (A/swine/Italy/2/1979(H1N1))		4		4		
2403		383537	Influenza A virus (A/swine/Iowa/1946(H1N1))		1		1		
2404		383550	Influenza A virus (A/duck/England/1/1956(H11N6))		2		2		
2406		383561	Influenza A virus (A/swine/Italy/1850/1977(H3N2))		1		1		
2407		383566	Influenza A virus (A/swine/Italy/425/1976(H1N1))		1		1		
2408		383568	Influenza A virus (A/Shanghai/11/1987(H3N2))		1		1		
2409		383571	Influenza A virus (A/Memphis/6/1986(H3N2))	4		4	1		1
2410		383574	Influenza A virus (A/Memphis/2/1985(H3N2))	1		1			
2411		383577	Influenza A virus (A/Memphis/1/1990(H3N2))		1		1		
2412		383578	Influenza A virus (A/Memphis/4/1980(H3N2))		1		1		
2413		383586	Influenza A virus (A/Memphis/1/1971(H3N2))	19	11	19	11		
2414		383602	Influenza A virus (A/Anas acuta/Primorje/695/1976(H2N3))		17		17		
2415		383603	Influenza A virus (A/turkey/Minnesota/833/1980(H4N2))		1		1		
2417		384483	Influenza A virus (A/swine/Hong Kong/127/1982(H3N2))		1		1		
2418		384484	Influenza A virus (A/swine/Hong Kong/81/1978(H3N2))		12		12		
2419		384487	Influenza A virus (A/Swine/Indiana/1726/1988(H1N1))		2		2		
2420		384493	Influenza A virus (A/seal/Mass/1/1980(H7N7))	1	1	1	1		
2421		384495	Influenza A virus (A/Kiev/59/1979(H1N1))		5		5		

2422		384498	Influenza A virus (A/Ann Arbor/6/1960(H2N2))		270		270		
2423		384499	Influenza A virus (A/gull/Maryland/704/1977(H13N6))		1		1		
2424		384500	Influenza A virus (A/Beijing/11/1956(H1N1))		30		30		
2426		384505	Influenza A virus (A/nt/60/1968(H3N2))		69		69		
2427		384509	Influenza A virus (A/tern/Australia/G70C/1975(H11N9))	9		9			
2428		384510	Influenza A virus (A/tern/South Africa/1961(H5N3))	1		1			
2429		384527	Influenza A virus (A/Cameron/1946(H1N1))		1		1		
2430		384676	Pseudomonas entomophila L48		1		1		
2431		384946	Influenza A virus (A/duck/Hungary/1/1970(H6N2))		1		1		
2432		385576	Influenza A virus (A/Alaska/6/1977(H3N2))		2		2		
2433		385580	Influenza A virus (A/duck/Ukraine/1/1963(H3N8))	3		3			
2434		385583	Influenza A virus (A/Denver/1957(H1N1))		2		2		
2435		385585	Influenza A virus (A/equine/Jilin/1/1989(H3N8))	1		1			
2436		385586	Influenza A virus (A/chicken/Pennsylvania/1/1983(H5N2))		1		1		
2437		385587	Influenza A virus (A/budgerigar/Hokkaido/1/1977(H4N6))		10		10		
2438		385599	Influenza A virus (A/udorn/1972(H3N2))		1		1		
2439		385600	Influenza A virus (A/Puerto Rico/8/1934(Cambridge)(H1N1))	1		1			
2440		385605	Influenza A virus (A/equine/Kentucky/2/1986(H3N8))		3		3		
2441		385616	Influenza A virus (A/ruddy turnstone/NJ/60/1985(N9))		1		1		
2442		385617	Influenza A virus (A/chicken/Pennsylvania/1370/1983(H5N2))	1		1			
2443		385624	Influenza A virus (A/Port Chalmers/1/1973(H3N2))	7	1	7	1		
2444		385630	Influenza A virus (A/Bangkok/1/1979(H3N2))	1	7	1	7		
2445		385640	Influenza A virus (A/Memphis/102/1972(H3N2))		8		8		
2446		385644	Influenza A virus (A/swine/Ukkel/1/1984(H3N2))		1		1		
2447		386032	Reston ebolavirus - Reston (1989)		4		4		
2448		386033	Sudan ebolavirus - Uganda (2000)	1	6	1	6		
2449		386043	Listeria welshimeri serovar 6b str. SLCC5334		3		3		
2450		386056	Paraburkholderia ferrariae		1		1		
2451		386415	Clostridium novyi NT		2		2		
2452		386585	Escherichia coli O157:H7 str. Sakai		17		17		
2453		386656	Yersinia pestis Pestoides F		2		2		
2454		387093	Sulfurovum sp. NBC37-1		1		1		
2455		387139	Influenza A virus (A/Aichi/2/1968(H3N2))	10	11	10	11		
2456		387147	Influenza A virus (A/England/878/1969(H3N2))	1	2	1	2		
2457		387156	Influenza A virus (A/Harbin/1/1988(H1N2))		17		17		
2458		387161	Influenza A virus (A/Japan/305/1957(H2N2))	4	29	4	29		
2459		387191	Influenza A virus (A/camel/Mongolia/1982(H1N1))		8		8		
2460		387203	Influenza A virus (A/duck/Bavaria/2/1977(H1N1))		1		1		
2461		387207	Influenza A virus (A/duck/Hokkaido/8/1980(H3N8))		6		6		
2463		387213	Influenza A virus (A/equine/Alaska/1/1991(H3N8))		1		1		
2464		387223	Influenza A virus (A/equine/Miami/1963(H3N8))	5		5			
2465		387239	Influenza A virus (A/gull/Delaware/475/1986(H2N2))		1		1		
2466		387243	Influenza A virus (A/herring gull/DE/677/1988(H2N8))		1		1		
2467		388041	Influenza A virus (A/bar-headed goose/Qinghai/1A/2005(H5N1))	1		1			
2468		388272	Pseudomonas aeruginosa PACS2		12		12		
2469		388634	Bombyx mandarina nuclear polyhedrosis virus		1		1		
2470		388799	HIV-1 group O	1		1			
2471		389259	Influenza A virus (A/Nagasaki/N03/2005(H3N2))		1		1		
2472		390236	Borreliella afzelii PKo	2		2			
2473		391646	Hepatitis B virus ayw3	1		1			
2474		391647	Hepatitis B virus ayw2	8		8			
2475		391650	Hepatitis B virus ayw4	1		1			
2476		391896	Rickettsia bellii OSU 85-389		3		3		
2477		392021	Rickettsia rickettsii str. 'Sheila Smith'		3	1	9	1	6
2478		392734	Terriglobus roseus		1		1		
2479		392809	Influenza A virus (A/Victoria/3/1975(H3N2))	45	9	45	9		
2480		392810	Influenza A virus (A/chicken/Rostock/8/1934(H7N1))	2	4	2	4		
2481		392811	Influenza A virus (A/Udorn/8/1972(H3N2))	1		1			
2482		393011	Francisella tularensis subsp. holarctica OSU18		6		6		
2483		393115	Francisella tularensis subsp. tularensis FSC198		85		85		
2484		393117	Listeria monocytogenes FSL J1-194		2		2		
2485		393124	Listeria monocytogenes FSL N3-165		2		2		
2486		393125	Listeria monocytogenes FSL R2-503		1		1		

2487		393126	Listeria monocytogenes FSL R2-561		1		1		
2488		393128	Listeria monocytogenes F6900		1		1		
2489		393130	Listeria monocytogenes J0161		6		6		
2490		393133	Listeria monocytogenes 10403S		4		4		
2491		393305	Yersinia enterocolitica subsp. enterocolitica 8081		16		16		
2493		393548	Influenza A virus (A/chicken/Tula/Russia/Oct-5/2005(H5N1))		1		1		
2494		393557	Influenza A virus (A/Leningrad/1954/1(H1N1))		8		8		
2495		393697	Influenza A virus (A/Liaoning/25/2000(H1N1))		1		1		
2496		393902	Influenza A virus (A/Wisconsin/67/2005(H3N2))	1	5	1	5		
2497		395095	Mycobacterium tuberculosis str. Haarlem		127		127		
2498		395494	Gallionella capsiferriformans ES-2		1		1		
2499		395841	Influenza A virus (A/duck/Hokkaido/1130/01(H1N1))		1		1		
2500		395842	Influenza A virus (A/tern/Australia/1/04(H2N5))		1		1		
2501		397342	Horsepox virus		6		6		
2503		398031	Toxoplasma gondii type III		1		1		
2504		398812	TGEV virulent Purdue	4		4			
2506		399741	Serratia proteamaculans 568		1		1		
2507		400331	Influenza A virus (A/New South Wales/15/1999(H3N2))		1		1		
2508		400667	Acinetobacter baumannii ATCC 17978	10	13	10	13		
2509		400788	Influenza A virus (A/Indonesia/5/2005(H5N1))	1	3	1	3		
2510		400810	Influenza A virus (A/Indonesia/CDC594/2006(H5N1))	1		1			
2511		400828	Influenza A virus (A/Indonesia/CDC669/2006(H5N1))	4		5		1	
2512		400830	Influenza A virus (A/Indonesia/CDC699/2006(H5N1))	2		2			
2514		401650	Listeria monocytogenes HPB2262		3		3		
2515		401671	HIV-1 M:B_89.6		1		1		
2516		402194	Influenza A virus (A/Istanbul/CTF/10/2004(H3N2))		1		1		
2517		402464	Influenza A virus (A/gray teal/Australia/2/1979(H4N4))		1		1		
2518		402489	Influenza A virus (A/turkey/Minnesota/1200/1980(H7N3))		1		1		
2519		402518	Influenza A virus (A/Canada/rv504/2004(H7N3))	1		1			
2520		402527	Influenza A virus (A/chicken/Scotland/1959(H5N1))		1		1		
2521		402938	Influenza A virus (A/Michigan/2/2003(H1N2))	1		1			
2522		404137	Influenza A virus (A/chicken/Beijing/nl/2002(H9N2))		1		1		
2524		404150	Influenza A virus (A/chicken/Hubei/wk/1997(H5N1))		2		2		
2526		404155	Influenza A virus (A/chicken/Hunan/fg/2004(H5N1))		2		2		
2527		404163	Influenza A virus (A/chicken/Jilin/hg/2002(H5N1))		1		1		
2528		404330	Streptococcus pyogenes serotype M2	2		2			
2529		404331	Streptococcus pyogenes serotype M4	2		2			
2530		404408	Influenza A virus (A/chicken/Shanxi/2/2006(H5N1))	1		1			
2531		404573	Influenza A virus (A/chicken/Netherlands/03010132/03(H7N7))	1		1			
2532		404974	Vibrio cholerae AM-19226		1		1		
2533		405050	Influenza A virus (A/tern/Australia/1402/2004(H2N5))		1		1		
2534		405531	Bacillus cereus G9842		3		3		
2535		405532	Bacillus cereus B4264		1		1		
2536		405533	Bacillus cereus AH1134		3		3		
2537		405536	Bacillus anthracis str. Tsiankovskii-I		1		1		
2538		405917	Bacillus cereus W		1		1		
2539		405955	Escherichia coli APEC O1		8		8		
2540		406269	West Nile virus strain PTRoxo		12		12		
2541		407134	Yellow fever virus strain Ghana/Asibi/1927		5		5		
2542		407141	Yellow fever virus isolate Ethiopia/Couma/1961		2		2		
2543		407148	Campylobacter jejuni subsp. jejuni 81116		14		14		
2544		407418	Influenza A virus (A/chicken/Guiyang/2147/2005(H5N1))		1		1		
2545		408599	Human rotavirus G9P[8]	1		1			
2546		408685	Dengue virus 1 Brazil/97-11/1997		1058		1058		
2547		408686	Dengue virus 4 Philippines/H241/1956	4	947	4	947		
2548		408687	Dengue virus 4 Singapore/8976/1995		5		5		
2549		408688	Dengue virus 4 Thailand/0348/1991		15		15		
2550		408689	Dengue virus 4 Thailand/0476/1997		3		3		
2551		408690	Dengue virus 3 China/80-2/1980		84		84		
2552		408691	Dengue virus 3 Martinique/1243/1999		889		889		
2553		408692	Dengue virus 3 Sri Lanka/1266/2000		66		66		
2554		408693	Dengue virus 3 Singapore/8120/1995		69		69		
2555		408694	Dengue virus 2 Peru/IQT2913/1996		87		87		

2556		408870	Dengue virus 3 Philippines/H87/1956	8	13	8	13		
2557		408871	Dengue virus 4 Dominica/814669/1981	1	256	1	256		
2558		410069	Streptococcus pyogenes serotype M80	1		1			
2559		410072	Coprococcus comes	1		1			
2560		410078	Human respiratory syncytial virus S2	1		1			
2561		410289	Mycobacterium tuberculosis variant bovis BCG str. Pasteur 1173P2	1	229	1	229		
2562		411157	Influenza A virus (A/Thailand/271/2005(H1N1))	1		1			
2563		411167	Influenza A virus (A/Queensland/11/2001(H3N2))		1		1		
2564		411662	Influenza A virus (A/Hanoi/TN405/2005(H3N2))		1		1		
2565		412022	Burkholderia mallei NCTC 10229		9		9		
2566		412419	Borrelia duttonii Ly	7		7			
2567		412420	Yersinia pestis CA88-4125		21		21		
2568		412614	Vibrio cholerae 2740-80		44		44		
2569		412694	Bacillus thuringiensis str. Al Hakam		8		8		
2570		412883	Vibrio cholerae MZO-3		1		1		
2571		412966	Vibrio cholerae 1587		3		3		
2572		412967	Vibrio cholerae MAK 757		9		9		
2573		413999	Clostridium botulinum A str. ATCC 3502		3		3		
2574		414044	Influenza A virus (A/Thailand/1(KAN-1A)/2004(H5N1))	1		1			
2575		415166	Influenza A virus(A/swine/Henan/2/2004(H9N2))		1		2		1
2576		415167	Influenza A virus(A/swine/Henan/3/2004(H9N2))		1		1		
2577		415169	Influenza A virus(A/swine/Henan/5/2004(H9N2))		1		1		
2578		415172	Influenza A virus(A/swine/Henan/8/2004(H9N2))		2		2		
2579		415176	Influenza A virus(A/swine/Shandong/fNY/2003(H9N2))		3		3		
2580		415177	Influenza A virus(A/swine/Shandong/fZC/2003(H9N2))		7		7		
2581		416035	Norovirus Hu/GII.4/DenHaag89/2006/NL	1		1			
2582		416276	Rickettsia massiliae MTU5		2		2		
2583		416674	Influenza B virus (B/Yamagata/16/1988)	4		4			
2584		416730	Influenza A virus (A/Memphis/10/1996(H1N1))		1		1		
2585		417398	Vibrio cholerae MZO-2		2		2		
2586		417399	Vibrio cholerae NCTC 8457		1		1		
2587		417400	Vibrio cholerae B33		5		5		
2588		417758	Influenza A virus (A/quail/Shantou/1475/2004(H9N2))	1		1			
2589		418136	Francisella tularensis subsp. tularensis WY96-3418		2		2		
2590		418868	Influenza A virus (A/Egypt/14724-NAMRU3/2006(H5N1))	1		1			
2591		419109	Vibrio parahaemolyticus AQ3810		38		38		
2592		419947	Mycobacterium tuberculosis H37Ra		130		130		
2593		420174	Hepatitis C virus isolate HC-J4	1	143	1	160		17
2594		420245	Leishmania braziliensis MHOM/BR/75/M2904	14	8	14	8		
2595		420246	Geobacillus thermodenitrificans NG80-2	1		1			
2596		420521	Expression vector pNIC-NHT-CF	1		1			
2597		420662	Methylibium petroleiphilum PM1		1		1		
2598		421472	Influenza A virus (A/Indonesia/CDC1032N/2007(H5N1))	1		1			
2599		421877	Hepatitis C virus isolate HC-J1	3	26	3	26		
2600		421901	Influenza A virus (A/Egypt/0636-NAMRU3/2007(H5N1))	2	1	2	1		
2601		423368	Salmonella enterica subsp. enterica serovar Newport str. SL254		1		1		
2602		424717	Shigella flexneri 3a	4		4			
2603		424718	Shigella flexneri 5a	2		2			
2604		424720	Shigella flexneri Y	8		8			
2605		425067	Burkholderia pseudomallei 305		2		2		
2606		425088	Tanganya virus		1		1		
2607		425551	Influenza A virus (A/AA/Huston/1945(H1N1))	1		1			
2608		425557	Influenza A virus (A/California/10/1978(H1N1))		1		1		
2609		426430	Staphylococcus aureus subsp. aureus str. Newman	2		7		5	
2610		426738	Influenza A virus (A/swine/Miyagi/5/2003(H1N2))		2		2		
2611		427773	Influenza A virus (A/Thailand/SP83/2004(H5N1))	1		1			
2612		427826	Influenza B virus (B/Hong Kong/8/1973)		1		1		
2613		427890	Influenza A virus (A/Viet Nam/JP4207/2005(H5N1))	1		1			
2615		430066	Brucella abortus S19		15		15		
2616		430417	Influenza A virus (A/Wyoming/3e5/2003(H3))	1		1			
2617		430511	Juquitiba virus		2		2		
2618		430557	Francisella tularensis subsp. tularensis FSC033		27		27		
2619		431944	Magnetospirillum gryphiswaldense MSR-1		1		1		

2620		431947	Porphyromonas gingivalis ATCC 33277	1	4	20	4	19	
2621		432070	Influenza A virus (A/Hong Kong/213/2003(H5N1))	1	4	1	4		
2622		432094	Influenza A virus (A/Wyoming/3/2003-X-147(H3N2))		1		1		
2623		432359	Toxoplasma gondii VEG	14		14			
2624		434922	Coxiella burnetii Dugway 5J108-111		8		8		
2625		434923	Coxiella burnetii CbuG_Q212		1		1		
2626		434924	Coxiella burnetii CbuK_Q154		1		1		
2627		435258	Leishmania infantum JPCM5	28	5	28	5		
2628		435359	Influenza A virus (A/chicken/Hebei/706/2005(H5N1))		2		2		
2629		436004	Influenza A virus (A/kunke/1/71(H3N2))		1		1		
2630		439235	Desulfatibacillum alkenivorans AK-01		1		1		
2631		439843	Salmonella enterica subsp. enterica serovar Schwarzengrund str. CVM19633		1		1		
2632		439847	Salmonella enterica subsp. enterica serovar Saintpaul str. SARA29		1		1		
2633		440534	Salmonella enterica subsp. enterica serovar 4,[5],12:i:- str. CVM23701		1		1		
2634		441158	Burkholderia pseudomallei 9		1		1		
2635		441159	Burkholderia pseudomallei 91		2		2		
2636		441160	Burkholderia pseudomallei 14		1		1		
2637		441769	Bacillus coahuilensis m4-4		1		1		
2638		441771	Clostridium botulinum A str. Hall	44		44			
2639		441962	Influenza A virus (A/duck/Mongolia/47/2001(H7N1))		3		3		
2640		444178	Brucella ovis ATCC 25840		8		8		
2641		444185	Simian rotavirus A strain RRV	10	1	10	1		
2642		444186	Simian rotavirus A strain TUCH		5		5		
2643		444318	Influenza A virus (A/Texas/1/1977(H3N2))	1	15	1	15		
2644		444793	Influenza A virus (A/Auckland/590/2000(H1N1))		1		1		
2645		445335	Clostridium botulinum NCTC 2916		2		2		
2646		445338	Clostridium botulinum str. Iwanei E	6		6			
2647	X	445983	Borreliella burgdorferi 156a			1		1	
2648		445985	Borreliella burgdorferi ZS7	2	45	3	45	1	
2649		446023	Influenza A virus (A/Hong Kong/68(H3N2))	1		1			
2651		447095	Blastomyces dermatitidis ATCC 26199		1		1		
2652		447133	Influenza A virus (A/chicken/Japan/1925(H7N7))	1		1			
2653		447188	Influenza A virus (A/duck/Tasmania/277/2007(H7N2))	1		1			
2654		448058	Influenza A virus (A/swine/Guangdong/01/2005(H3N2))		1		1		
2655		449278	West Nile virus SPU116/89		1		1		
2656		449656	Influenza A virus (A/chicken/Taiwan/2838V/00(H6N1))	15		15			
2658		451707	Bacillus cereus NVH0597-99		7		7		
2659		451708	Bacillus cereus H3081.97		12		12		
2660		451709	Bacillus cereus 03BB108		8		8		
2661		451804	Aspergillus fumigatus A1163		13		13		
2662		452646	Neovison vison		1		1		
2663		452652	Kitasatospora setae KM-6054		1		1		
2664		452659	Rickettsia rickettsii str. Iowa		1		1		
2665		453057	Influenza A virus (A/Indonesia/CDC540/2006(H5N1))	1		1			
2666		453927	Juniperus formosana	1		1			
2668		458234	Francisella tularensis subsp. holarctica FTNF002-00		1		1		
2669		458678	Hantaanvirus CGRn93P8		2		2		
2670		461739	Influenza B virus (B/Florida/4/2006)	1		1			
2671		461772	Influenza A virus (A/Wisconsin/43/2006(H3N2))	1		1			
2672		462695	Influenza A virus (A/Hiroshima/52/2005(H3))	2		2			
2673		463722	Murine norovirus GV/CR6/2005/USA		1		1		
2674		464314	Influenza A virus (A/Anhui/T2/2006(H5N1))	1		1			
2675		464417	Influenza B virus (B/Malaysia/2506/2004)	1		1			
2676		464622	Influenza A virus (A/Solomon Islands/3/2006 (Egg passage)(H1N1))	1		1			
2677		464623	Influenza A virus (A/Solomon Islands/3/2006(H1N1))	9		12		3	
2678		465541	Streptomyces sp. Mg1		1		1		
2679		467144	Modified Vaccinia Ankara virus		22		22		
2680		468968	Influenza A virus (A/Indonesia/560H/2006(H5N1))	1		1			
2681		470137	Brucella suis ATCC 23445	1	5	1	5		
2682		471223	Geobacillus sp. WCH70		2		2		
2683		471721	HIV-1 CRF01_AE	1		1			
2684		472511	Influenza A virus (A/Indonesia/TLL007/2006(H5N1))	1		1			
2685		475478	Influenza A virus (A/equine/New Market/1/1979(H3N8))	1		1			

2686		475493	Influenza A virus (A/equine/California/8560/2002(H3N8))		2		2		
2687		476294	Influenza A virus (A/Brisbane/10/2007(H3N2))	5		5			
2688		476303	Influenza A virus (A/California/04/2007(H1N1))		1		1		
2689		478005	Escherichia coli O157:H7 str. EC4486		1		1		
2690		478006	Escherichia coli O157:H7 str. EC4501		2		2		
2691		478008	Escherichia coli O157:H7 str. EC869		13		13		
2692		480019	Influenza A virus (A/Moscow/10/1999(H3N2))		2		2		
2693		480024	Influenza A virus (A/Wyoming/03/2003(H3N2))		8		8		
2694		481805	Escherichia coli ATCC 8739		1		1		
2695		482134	Hepatitis B virus adw/Japan/Nishioka/1983		1		1		
2696		482628	Campylobacter jejuni subsp. jejuni BH-01-0142		1		1		
2697		482957	Burkholderia lata		2		2		
2698		483179	Brucella canis ATCC 23365		9		9		
2699		484021	Klebsiella pneumoniae subsp. pneumoniae NTUH-K2044		1		1		
2700		486280	Torque teno virus VT416		3		3		
2701		486619	Bacillus anthracis str. A0193		3		3		
2702		486620	Bacillus anthracis str. A0465		5		5		
2703		486621	Bacillus anthracis str. A0442		1		1		
2704		486623	Bacillus anthracis str. A0389		5		5		
2705		486624	Bacillus anthracis str. A0488		91		91		
2706		487067	Torque teno virus Human/Ghana/GH1/1996		3		3		
2707		487521	Mycobacterium intracellulare ATCC 13950	1		1			
2708		488233	Influenza A virus (A/Iran/1/1957(H2N2))		1		1		
2709		488241	Influenza A virus (A/Korea/426/1968(H2N2))		2		2		
2710		489455	HBV genotype A	1		1			
2711		489460	HBV genotype B	1		1			
2712		489466	HBV genotype C	10		10	11		11
2713		489469	Hepatitis B virus ayw/China/Tibet127/2002	1		1			
2714		489483	HBV genotype D	1	3	1	3		
2715		489821	Norovirus GII.4	1	10	2	11	1	1
2716		489822	Norovirus Hu/Houston/TCH186/2002/US	2		2			
2717		490039	Norovirus GII.2	1		1			
2718	X	490041	Norovirus GII.3			1		1	
2719		490133	Hepatitis B virus ayw/France/Tiollais/1979		4		4		
2720		493803	Merkel cell polyomavirus	2	2	2	2		
2721		496036	Influenza A virus (A/duck/Vietnam/37/2007(H5N1))		1		1		
2722		497976	Salmonella enterica subsp. enterica serovar Typhi str. E00-7866		1		1		
2723		497977	Salmonella enterica subsp. enterica serovar Typhi str. 404ty		1		1		
2724		499191	Norovirus GII.1	1		1			
2725		499286	Influenza A virus (A/Hong Kong/CUHK13527/2003(H3N2))		2		2		
2726		502057	Vaccinia virus GLV-1h68		2		2		
2727		502780	Paracoccidioides brasiliensis Pb18	1	1	1	1		
2728		502790	Aeromonas diversa		1		1		
2729		503386	Influenza B virus (B/Kobe/3/2004)	1		1			
2730		504660	Influenza B virus (B/Kobe/67/2005)	1		1			
2731		504662	Influenza B virus (B/Kobe/39/2005)	1		1			
2732		504664	Influenza B virus (B/Kobe/113/2005)	1		1			
2733		504666	Influenza B virus (B/Kobe/115/2005-T1)	1		1			
2734		504697	Influenza A virus (A/Cygnus olor/Czech Republic/10732/07(H5N1))		1		1		
2735		504904	Influenza A virus (A/Brisbane/59/2007(H1N1))	26	13	26	13		
2736		504910	Influenza A virus (A/Wellington/75/2006(H1N1))		1		1		
2737		505184	HIV-1 M:A	9	1	9	1		
2738		505185	HIV-1 M:B	8	1	8	1		
2739		505186	HIV-1 M:C	10		10			
2740		505228	HIV-1 M:G	4		4			
2741		506282	Influenza A virus (A/unknown/New York/11646-5/2005(H7N2))	1		1			
2742		506350	Influenza A virus (A/Hong Kong/1/1968(H3N2))	18	2	18	3		1
2744		507601	Toxoplasma gondii GT1		205		205		
2745		508767	Clostridium botulinum E3 str. Alaska E43		1		1		
2746		508771	Toxoplasma gondii ME49	21	88	21	89		1
2747		508775	Norovirus GII.9	1	1	1	1		

2748		509173	Acinetobacter baumannii AYE		1		1		
2750		510222	Influenza A virus (A/duck/Vietnam/NCVD-9/2007(H5N1))	1		1			
2751		511145	Escherichia coli str. K-12 substr. MG1655		31		31		
2752		511839	Influenza A virus (A/turkey/England/N28/1973(H5N2))	1		1			
2753		514193	Influenza A virus (A/CHU/2-524/2005(H3N2))		2		2		
2754		515581	Influenza A virus (A/swine/Ohio/24366/2007(H1N1))		1		2		1
2756		515817	Amphioctopus fangsiao	1		1			
2757		518922	Influenza A virus (A/Beijing/262/1995(H1N1))	1		1			
2758		518968	Influenza A virus (A/X-31B(Puerto Rico/8/1934-Aichi/2/1968)(H3N2))	1		1			
2759		518987	Influenza B virus (B/Lee/1940)	5	3	5	3		
2761		520450	Brucella abortus bv. 2 str. 86/8/59		1		1		
2762		520464	Brucella melitensis bv. 1 str. Rev.1	1		1			
2763		520963	Norovirus GII.11	1		1			
2764		520964	Norovirus GII.18	1		1			
2765		521004	Haemophilus influenzae 6P18H1		1		1		
2766		521005	Haemophilus influenzae 7P49H1		1		1		
2767		521007	Borreliella burgdorferi N40	4	3	4	3		
2768		522740	Influenza A virus (A/swine/Hannover/1/1981(H1N1))		12		12		
2769		524364	Norovirus Hu/1968/US	3	1	3	1		
2770		525281	Escherichia coli 83972		3		3		
2771		525368	Mycobacterium parascrofulaceum ATCC BAA-614		35		35		
2772		525374	Staphylococcus epidermidis BCM-HMP0060		1		1		
2773		526974	Bacillus cereus BDRD-ST24		1		1		
2774		526977	Bacillus cereus ATCC 4342		1		1		
2776		527024	Bacillus thuringiensis serovar tochigiensis BGSC 4Y1		1		1		
2777		527026	Bacillus thuringiensis serovar sotto str. T04001		1		1		
2779		528354	Neisseria gonorrhoeae MS11	8		8			
2780		529058	Influenza A virus (A/Uruguay/716/2007(H3N2))	1		1			
2781		529507	Proteus mirabilis HI4320	1		1			
2782		533026	Influenza A virus (A/turkey/Ohio/313053/2004(H3N2))	1	2	1	2		
2783		535026	Bacillus subtilis subsp. subtilis str. NCIB 3610		1		1		
2784		535852	Influenza A virus (A/California/06/2008(H1N1))		1		1		
2785		538555	Influenza A virus (A/swine/Korea/Hongsong2/2004(H1N2))		2		2		
2786		543153	Mycobacterium phage Predator		1		1		
2787		543824	Synechocystis aquatilis		2		2		
2788		546980	Norovirus Hu/GII-4/Saga1/2006/JP	1		1			
2789		548470	Staphylococcus aureus subsp. aureus MN8	11		11			
2790		549169	Pseudogulbenkiania ferrooxidans		1		1		
2791		552536	Listeria monocytogenes HCC23		2		2		
2792		553345	Influenza A virus (A/Aichi/72/2007(H3N2))	1		1			
2793		553583	Staphylococcus aureus A9635	1		1			
2794		554290	Salmonella enterica subsp. enterica serovar Paratyphi A str. AKU_12601		3		3		
2795		557433	Lactobacillus reuteri JCM 1112	3		3			
2796		557599	Mycobacterium kansasii ATCC 12478	1		1			
2797		558177	Influenza A virus (A/mallard/Bavaria/10/2007(H5N1))		1		1		
2798		559292	Saccharomyces cerevisiae S288C	8		16	1	8	1
2799		560463	Influenza A virus (A/Taiwan/VGHYM0325-06/2002(H3N2))		1		1		
2802		562988	Influenza A virus (A/Egypt/2289-NAMRU3/2008(H5N1))	1		1			
2803		562992	Influenza A virus (A/Egypt/3300-NAMRU3/2008(H5N1))	1		1			
2804		563041	Helicobacter pylori G27	2		2			
2805		563773	Vibrio parahaemolyticus AN-5034		4		4		
2806		565995	Bundibugyo ebolavirus	7		14		7	
2808		566466	gamma proteobacterium NOR5-3		1		1		
2809		567106	Campylobacter jejuni subsp. jejuni IA3902		1		1		
2810		568206	Bacillus anthracis str. CDC 684		3		3		
2811		568819	Listeria monocytogenes serotype 4b str. CLIP 80459		6		6		
2812		571800	Psychrobacter sp. G	1		1			
2813		572264	Bacillus cereus 03BB102		2		2		
2814		572307	Neospora caninum Liverpool		1		1		
2815		573797	Influenza A virus (A/England/654/2007(H1N1))		1		1		
2816		573977	Human bocavirus 2	4		4			
2817		574556	Anaplasma centrale str. Israel		2		2		
2818		575590	Bacteroidetes oral taxon 274 str. F0058	1		1			

2819		575591	Brucella abortus NCTC 8038		1		1		
2820		575788	Vibrio tasmaniensis LGP32		1		1		
2822		577543	Influenza A virus (A/Xinjiang/1/2006(H5N1))	4		4			
2823		578079	Influenza A virus (A/ferret/Maryland/P10-UMD/2008(H9N2))		1		1		
2824	X	580047	Chlamydia trachomatis A2497			1		1	
2825		585034	Escherichia coli IAI1	3		3			
2826		585544	Bacteroides sp. D22	1		1			
2827		587200	Variola virus human/India/Ind3/1967		4		4		
2828		587884	Influenza A virus (A/Sydney/5/1997(H3N2))	7		7			
2829		588533	Norovirus Hu/GII/GZ-1/2008/CHN	1		1			
2830		591020	Shigella flexneri 2002017		1		1		
2831		592021	Bacillus anthracis str. A0248		1		1		
2832		592313	Vibrio cholerae 12129(1)		1		1		
2833		598745	Giardia intestinalis ATCC 50581		7		7		
2834		604436	Influenza B virus (B/Brisbane/60/2008)	2		2			
2835		614035	Influenza A virus (A/swine/Belgium/1/1998(H1N1))	1		1			
2836		616922	Influenza A virus (A/chicken/Anhui/1/1998(H9N2))		1		1		
2837		617102	Yellow fever virus 17D/Tiantan	4	5	4	5		
2838		619693	Prevotella sp. oral taxon 472 str. F0295	1		1			
2839		627442	SARS coronavirus P2	1		1			
2840		627611	Vibrio parahaemolyticus K5030		22		22		
2841		630277	Tarsius lariang		1		1		
2842		632134	Influenza A virus (A/chicken/Pakistan/UDL-01/2008(H9N2))	7		7			
2843		633557	Infectious bronchitis virus CK/CH/LHLJ/04V	1		1			
2844	X	634464	Chlamydia trachomatis Sweden2			1		1	
2845		637383	Helicobacter pylori NCTC 11639		2		8		6
2846		638313	Human bocavirus 3	6		6			
2847		641140	Brucella abortus str. 2308 A		1		1		
2848		641501	Influenza A virus (A/California/04/2009(H1N1))	65	103	74	127	9	24
2849		641809	Influenza A virus (A/California/07/2009(H1N1))	25	13	31	14	6	1
2850		641812	Influenza A virus (A/Texas/05/2009(H1N1))	1		1			
2851		642261	Influenza A virus (A/California/08/2009(H1N1))	8		8			
2852		642794	Influenza A virus (A/Auckland/1/2009(H1N1))		1		1		
2853		643212	Influenza A virus (A/Netherlands/602/2009(H1N1))	2	14	2	14		
2854		643680	Saccharomyces cerevisiae EC1118		1		1		
2855		644289	Influenza A virus (A/Korea/01/2009(H1N1))	3		3			
2856		644788	Influenza A virus (A/Vietnam/1194/2004(H5N1))	13	4	14	9	1	5
2857	X	645463	Clostridioides difficile R20291			1		1	
2858		645724	Influenza A virus (A/Hong Kong/01/2009(H1N1))	3		3			
2859	X	645771	Influenza A virus (A/Catalonia/63/2009(H1N1))				1		1
2860		647096	Influenza A virus (A/Beijing/01/2009(H1N1))		24		27		3
2861		647514	Norovirus GI.1	1		1			
2862		647515	Norovirus GI.2	1		1			
2863		647516	Norovirus GI.3		1		1		
2864		647519	Norovirus GI.5	1		1			
2865		647521	Norovirus GI.7	1		1			
2866		647923	Influenza A virus (A/reassortant/NYMC X-179A(California/07/2009 x NYMC X-157)(H1N1))	7		16		9	
2867		648194	Neisseria meningitidis serogroup Y	3		3			
2868		648856	Influenza A virus (A/Beijing/501/2009(H1N1))	1		1			
2869		650131	Equine rhinitis B virus 1 strain P1436/71	6		6			
2870		652616	Mycobacterium tuberculosis str. Erdman = ATCC 35801	15	19	15	19		
2871		654811	Influenza A virus (A/Perth/16/2009(H3N2))	1		3		2	
2872		655288	Influenza A virus (A/mallard/Quebec/10969/2006(H2N3))		1		1		
2873	X	655827	Metarhizium acridum CQMa 102			1		1	
2874		655863	Grosmannia clavigera kw1407		1		1		
2875		657165	Influenza A virus (A/Hong Kong/213/03)	2	2	2	2		
2876		658578	Influenza A virus (A/duck/Beijing/MG0617/2005(H9N2))		1		1		
2877		658655	Lachnospiraceae bacterium 1_4_56FAA		1		1		
2878		658858	Giardia lamblia P15		1		1		
2879		661367	Legionella longbeachae NSW150		1		1		
2881		667015	Bacteroides salanitronis DSM 18170		1		1		
2882	X	672161	Chlamydia trachomatis B/TZ1A828/OT			3		3	

2883		673446	Influenza A virus (A/reassortant/NYMC X-181(California/07/2009 x NYMC X-157)(H1N1))	1		1			
2884		679206	Escherichia coli MS 119-7		1		1		
2885		679716	Trypanosoma brucei gambiense DAL972		1		1		
2886		680689	Influenza A virus (A/England/AV877/1996(H7N7))		1		1		
2887		680690	Influenza A virus (A/Hong Kong/1074/1999(H9N2))	2	1	2	1		
2888		680692	Influenza A virus (A/Hong Kong/485/1997(H5N1))	1	1	1	1		
2889		680693	Influenza A virus (A/Netherlands/219/2003(H7N7))	1		1			
2890		680729	Influenza A virus (A/chicken/Italy/1067/1999(H7N1))		17		17		
2891		680739	Influenza A virus (A/chicken/Mexico/37821-771/1996(H5N2))		1		1		
2892		680767	Influenza A virus (A/duck/Hong Kong/140/1998(H5N1))		1		1		
2893		680785	Influenza A virus (A/environment/Hong Kong/156/1997(H5N1))	1		1			
2894		680789	Influenza A virus (A/environment/Viet Nam/1203/2004(H5N1))	1		1			
2895		680799	Influenza A virus (A/goose/Hong Kong/437-6/1999(H5N1))		1		1		
2896		680803	Influenza A virus (A/goose/Hong Kong/739.2/2002(H5N1))		1		1		
2898		682728	Influenza A virus (A/Quebec/144147/2009(H1N1))	10		10			
2899		687340	Torque teno virus 1		3		3		
2900		687341	Torque teno virus 2		4		4		
2901		687342	Torque teno virus 3		4		4		
2902		687343	Torque teno virus 4		6		6		
2903		687345	Torque teno virus 6		2		2		
2904		687346	Torque teno virus 7		3		3		
2905		687347	Torque teno virus 8		6		6		
2906		687350	Torque teno virus 11		1		1		
2907		687353	Torque teno virus 14		5		5		
2908		687354	Torque teno virus 15		3		3		
2909		687355	Torque teno virus 16		4		4		
2910		687358	Torque teno virus 19		5		5		
2911		687359	Torque teno virus 20		2		2		
2912		687360	Torque teno virus 21		2		2		
2913		687362	Torque teno virus 23		2		2		
2914		687363	Torque teno virus 24		3		3		
2915		687364	Torque teno virus 25		3		3		
2916		687365	Torque teno virus 26		5		5		
2917		687366	Torque teno virus 27		5		5		
2918		687367	Torque teno virus 28		3		3		
2919		687368	Torque teno virus 29		4		4		
2920		687369	Torque teno mini virus 1		1		1		
2921		687371	Torque teno mini virus 3		2		2		
2922		687375	Torque teno mini virus 7		2		2		
2923		687376	Torque teno mini virus 8		2		2		
2924		687382	Torque teno tamarin virus		2		2		
2925		687383	Torque teno douroucouli virus		5		5		
2926		687384	Torque teno felis virus		1		1		
2927		687385	Torque teno canis virus		1		1		
2928		687386	Torque teno sus virus 1a	12	1	12	1		
2929		689403	Human bocavirus 1	8		8			
2932		694009	Severe acute respiratory syndrome-related coronavirus		1		1		
2933		696871	Vaccinia virus Western Reserve		4		4		
2934		697610	Influenza A virus (A/India/GWMH05/2009(H1N1))		1		1		
2935		703352	Brucella melitensis M5-90	5	26	5	26		
2936		714978	Human adenovirus 55	4		4			
2937		715091	Influenza A virus (A/Roma/ISS1941/2009(H1N1))		1		1		
2938		715494	Influenza A virus (A/Hong Kong/33982/2009(H9N2))		3		3		
2939		722438	Mycoplasma pneumoniae FH	3		3			
2940		742305	Influenza A virus (A/slaty-backed gull/Japan/6KS0185/2006(H4N8))		1		1		
2941		742503	Tokudaia muenninki		1		1		
2942		743722	Sphingobacterium sp. 21	1		1			
2943		743973	Taylorella equigenitalis ATCC 35865	1		1			
2944		744533	Naegleria gruberi strain NEG-M	1		1			
2945		746128	Aspergillus fumigatus	126	86	126	86		

2946		747305	Norovirus GII.10	1		7		6	
2947		754027	Treponema phagedenis F0421		1		1		
2948		754366	Influenza A virus (A/Ontario/309862/2009(H1N1))	1		1			
2949		754503	Mycoplasma hyopneumoniae 7422	1		1			
2950		759272	Chaetomium thermophilum var. thermophilum DSM 1495	1		1			
2951		761193	Runella slithyformis DSM 19594		1		1		
2952		761251	Influenza A virus (A/Mexico City/WR1704T/2009(H1N1))		1		1		
2953		762378	Influenza A virus (A/bar-headed goose/Qinghai/3/2005(H5N1))		1		1		
2955		763552	Mus musculus papillomavirus type 1		4		4		
2956		768646	Influenza A virus (A/chicken/Uchal/8293/2006(H9N2))		1		1		
2957		768647	Influenza A virus (A/chicken/Uchal/8286/2006(H9N2))		1		1		
2958		857099	Streptococcus mutans OMZ175	2	1	2	1		
2959		857571	Moraxella catarrhalis O35E	3		27		24	
2960		868597	Stenotrophomonas maltophilia JV3	1		1			
2961		870484	Nonlabens agnitus		1		1		
2962		871575	Ogataea parapolymorpha DL-1		1		1		
2963		875328	Mycolicibacter sinensis		10		10		
2965		885311	Entamoeba histolytica KU27		1		1		
2966		887118	Influenza A virus (A/Mexico/UASLP-012/2008(H3N2))		1		1		
2967		908203	Influenza A virus (A/Thailand/CU-H126/2009(H1N1))		1		1		
2968		909420	Neisseria meningitidis H44/76	1		2		1	
2969		913028	Yersinia enterocolitica W22703		1		1		
2970		915014	Influenza A virus (A/swine/Heilongjiang/44/2009(H1N1))	1		1			
2971		928301	Fowlpox virus strain NVSL		3		3		
2972		928313	Tacaribe virus strain Franze-Fernandez		6		6		
2973		929439	Leishmania mexicana MHOM/GT/2001/U1103		1		1		
2974		932622	Influenza A virus (A/chicken/Huadong/4/2008(H5N1))	1		1			
2975		935198	Clostridium botulinum B str. Eklund 17B (NRP)		1		1		
2976		936115	Influenza A virus (A/Netherlands/18/1994(H3N2))		1		1		
2977		940614	Granulicella mallensis		1		1		
2978		947939	Influenza A virus (A/aquatic bird/Korea/w44/2005(H7N3))		1		1		
2979	X	981087	Leishmania donovani BPK282A1				9		9
2980		986174	Influenza A virus (A/swine/Korea/4382/2009(H1N2))		1		1		
2981		991335	Influenza A virus (A/swine/Hong Kong/71/2009(H1N1))		1		1		
2982		992121	Helicobacter pylori Hp M5	1		1			
2983		996581	Influenza A virus (A/chicken/Shanghai/Q0808-1/2008(H9N2))		1		1		
2984		1003835	Severe fever with thrombocytopenia virus	1		1			
2985		1004253	Cyberlindnera mrakii	1	1	1	1		
2986		1005048	Collimonas fungivorans Ter331		2		2		
2987		1005962	Ogataea parapolymorpha		1		1		
2988		1006581	Mycoplasma gallisepticum S6	1		1			
2989		1009714	Pseudomonas aeruginosa PAK	7	3	7	3		
2990		1016852	Banana streak CA virus	5		5			
2991		1016853	Banana streak IM virus	10		10			
2992		1016998	Salmonella enterica subsp. enterica serovar Paratyphi B str. SPB7		11		11		
2993		1035514	Plasmodium vivax North Korean	1		1			
2994		1041522	Mycobacterium colombiense CECT 3035		20		20		
2995		1041990	Influenza A virus (A/Guangdong/15/2007(H3N2))	3		3			
2996		1045775	Paenibacillus catalpae	1		1			
2997	X	1050221	Chlamydia psittaci NJ1			10		10	
2998		1053141	Recombinant Hepatitis C virus J6/JFH1-J6	2		2			
2999		1068705	Influenza A virus (A/swine/Guangdong/221/2009(H1N1))		1		1		
3000		1077587	Influenza B virus (B/Victoria/2/1987)	2	1	2	4		3
3001		1081253	Influenza A virus (A/Indiana/08/2011(H3N2))		6		6		
3002		1082519	Influenza A virus (A/chicken/Taixing/10/2010(H9N2))	2		2			
3003		1086859	Influenza A virus (A/Bilthoven/4791/1981(H3N2))		3		3		
3004		1091045	Cutibacterium acnes subsp. defendens ATCC 11828	5		5			
3005		1093545	Influenza A virus (A/shorebird/Delaware Bay/277/2000(H9N7))		1		1		
3006	X	1112253	Chlamydia psittaci 02DC14			1		1	
3007	X	1112258	Chlamydia psittaci 02DC22			1		1	
3008	X	1112262	Chlamydia psittaci 03DC29			1		1	

3009		1117322	Glaesserella parasuis str. Nagasaki	1		1			
3010		1122279	Influenza A virus (A/equine/Guangxi/3/2011(H9N2))		1		1		
3011		1125722	Porphyromonas gingivalis W50		36		36		
3012		1126212	Macrophomina phaseolina MS6		1		1		
3013		1133363	Schmallenberg virus	6		6			
3014	X	1133968	Babesia microti strain RI			3		3	
3015		1144025	Influenza A virus (A/Shandong/9/1993(H3N2))	13		13			
3016		1146883	Blastococcus saxobsidens DD2		1		1		
3017		1156983	Norovirus Hu/GII.4/Minerva/CS1258/2006/USA	1		1			
3018		1163697	Influenza A virus (A/Oklahoma/309/2006(H3N2))	4	3	4	3		
3019		1169127	Clostridioides difficile genomovar ribotype_087	1		1			
3020		1171336	Influenza A virus (A/swine/Nebraska/A01116984/2011(H3N2))		1		1		
3021		1172206	Neisseria meningitidis NMB	1		1			
3022		1176042	Influenza A virus (A/swine/Italy/1513-1/1998(H1N1))		1		1		
3023		1178016	Encephalitozoon romaleae SJ-2008		1		1		
3024		1182144	Norovirus Hu/GII.4/Minerva/2006/USA	2		2			
3025		1184252	Streptococcus suis S735	2		2			
3026		1186058	Trichosporon asahii var. asahii CBS 2479		1		1		
3027		1197131	Escherichia coli F576	1		1			
3028		1198627	Mycobacteroides abscessus subsp. massiliense str. GO 06		1		1		
3029		1198676	Streptococcus mutans GS-5		14		14		
3030		1207470	Streptococcus pyogenes M1 476	1		1			
3031		1209523	Toxoplasma gondii type II		2		2		
3032		1209525	Toxoplasma gondii type I		2		2		
3033		1214154	Streptococcus suis 2651	1		1			
3034		1214159	Streptococcus suis 13730	2		2			
3035		1214225	Acidocella sp. MX-AZ02	1		1			
3036		1218488	Torque teno sus virus k2	11		11			
3037		1219377	Human rhinovirus C3		52		52		
3038		1225860	Porcine torque teno virus 1	2		2			
3039	X	1229831	Chlamydia avium 10DC88			2		2	
3040		1235996	Human betacoronavirus 2c EMC/2012	7		7			
3041		1236978	Staphylococcus epidermidis JCM 2414	1		1			
3042		1239567	Mamastrovirus 3	2		2			
3043		1241973	Norovirus Hu/GII.4/Sydney/NSW0514/2012/AU	1		3		2	
3044		1263102	Prevotella copri CAG:164		1		1		
3045		1263720	Betacoronavirus England 1	5		9		4	
3046		1268303	Rhodococcus sp. AW25M09	1	1	1	1		
3047	X	1268360	Influenza A virus (A/Victoria/361/2011(H3N2))			4		4	
3048		1278073	Myxococcus stipitatus DSM 14675		1		1		
3049		1285600	Nile crocodilepox virus		2		2		
3050		1285902	Artificial vector pGEX-2T	1		1			
3051		1286616	Norovirus Hu/GII.3/693/425/2008/AU	6		6			
3052		1286635	Desulfotignum phosphitoxidans DSM 13687		1		1		
3053		1288825	Shigella flexneri 2b	2		2			
3054		1289562	Influenza A virus (A/swine/Spain/SF11131/2007(H1N1))		3		3		
3055		1310532	Influenza A virus (A/chicken/West Java/Sbg-29/2007(H5N1))	7		7			
3056		1318439	Influenza A virus (A/Washington/05/2011(H1N1))	1		1			
3057	X	1321009	Influenza A virus (A/Texas/50/2012(H3N2))			1		1	
3059		1331560	Influenza A virus (A/Singapore/H2011.447/2011(H3N2))	1		1			
3060		1332244	Influenza A virus (A/Shanghai/02/2013(H7N9))	7		9		2	
3061		1335626	Middle East respiratory syndrome-related coronavirus	4	12	6	12	2	
3062		1337063	Puumala virus bank vole/CG1820/Russia/1984		1		1		
3063		1337393	Helicobacter pylori PZ5056	1		1			
3064		1342397	Influenza A virus (A/chicken/Hong Kong/TP38/2003(H9N2))		3		3		
3065		1342434	Influenza A virus (A/turkey/Minnesota/511/1978(H9N2))		1		1		
3066		1345266	HIV-1 M:CRF01_AE	1		1			
3067		1346336	Influenza A virus (A/Fort Monmouth/1-JY2/1947(H1N1))		1		1		
3068		1352357	Helicobacter pylori SouthAfrica50	1		1			
3069		1355477	Bradyrhizobium diazoefficiens		1		1		
3070		1380386	Mycobacterium sp. URHB0044		1		1		
3071		1389959	Mycobacterium tuberculosis variant bovis AN5	9	28	9	28		
3072		1391655	Influenza A virus (A/Aichi/2-1/1968(H3N2))	1		1			

3074		1392869	Escherichia coli K1		1		1		
3075	X	1398154	Sporothrix brasiliensis 5110				4		4
3076		1399582	Duck Tembusu virus	3		7		4	
3077		1401444	Avian leukosis virus ev/J	5		5			
3078		1403335	Porphyromonas gingivalis 381	71	55	71	55		
3079		1403514	Influenza A virus (A/chicken/Jiangsu/x1/2004(H9N2))	7		7			
3080	X	1405296	Chlamydia suis MD56			1		1	
3081		1408475	Taylorella asinigenitalis ATCC 700933	1		1			
3082		1413188	Influenza A virus (A/Anhui/PA-1/2013(H7N9))	1	3	1	3		
3083		1416333	Trypanosoma cruzi Dm28c	2		2			
3084		1420840	Influenza A virus (A/Luxembourg/46/2009(H1N1))		1		1		
3085	X	1427371	Chlamydia pecorum VR629			5		5	
3086		1432555	Escherichia coli ISC7		1		1		
3087		1440122	Murid herpesvirus 68		2		2		
3088	X	1447813	Influenza A virus (A/Shanghai/5190T/2013(H7N9))				6		6
3089	X	1451093	Influenza A virus (A/chicken/Taiwan/67/2013(H6N1))				5		5
3090	X	1457141	Chlamydia avium			1		1	
3091	X	1457153	Chlamydia gallinacea			3		3	
3092		1458279	Staphylococcus aureus USA300-ISMMS1	1		1			
3093		1463841	Streptomyces sp. NRRL F-2580		1		1		
3094		1464048	Micromonospora parva		1		1		
3095		1470614	Influenza A virus (A/swine/Thailand/CU-S3673N/2012(H3N2))		1		1		
3096		1476909	Banana streak MY virus	39		39			
3097		1481964	Influenza A virus (A/Anhui/1-DEWH730/2013(H7N9))	1	35	1	35		
3098		1498499	Legionella norrlandica		1		1		
3099		1507381	Influenza A virus (A/Minnesota/11/2010(H3N2))	10		11		1	
3102		1581419	Amblyomma sculptum	1		1			
3103	X	1634342	Norovirus Hu/GII/JP/2015/GII.P17_GII.17/Kawasaki308			1		1	
3104		1663864	Influenza A virus (A/Anhui/1-YK_RG134/2013(H7N9))		1		1		
3105		1663934	Influenza A virus (A/Anhui/1-YK_RG64/2013(H7N9))		2		2		
3106		1663996	Influenza A virus (A/Anhui/1-YK_RG01/2013(H7N9))	1		1			
3107		1665645	Norovirus GI/Hu/NL/2012/GI.6/Groningen		1		1		
3108		1671798	Human papillomavirus type 54		1		1		
3109		1727172	Influenza A virus (A/duck/Bavaria/1/1977(H1N1))		2		2		
3110		1835656	Rotavirus A RVA/Cow-tc/USA/B223/1983/G10P[11]	2		2			
3111	X	1891187	Zaire ebolavirus Makona				34		34
3112		1891729	Mesocricetus auratus polyomavirus 1	11		11			
3113		1891730	Mus musculus polyomavirus 1	4	30	4	30		
3114		1891762	Human polyomavirus 1	3	52	3	52		
3115		1891767	Macaca mulatta polyomavirus 1	16	42	16	42		
3116		1898104	Bacteroidetes bacterium		1		1		
3117		1933300	Watermelon silver mottle tospovirus	3		3			
3118		1979160	Human rubulavirus 2	10		10			
3119		1979162	Mammalian rubulavirus 5	1	1	1	1		
3120		1979165	Mumps rubulavirus	3		3			
3121		1980442	Orthohantavirus		15		15		
3122		1980456	Andes orthohantavirus	2	77	2	77		
3123		1980459	Bayou orthohantavirus	1		1			
3124		1980463	Cano Delgadito orthohantavirus		1		1		
3125		1980467	Dobrava-Belgrade orthohantavirus		25		25		
3126		1980468	El Moro Canyon orthohantavirus		2		2		
3127		1980471	Hantaan orthohantavirus	2	52	2	60		8
3128		1980475	Khabarovsk orthohantavirus		1		1		
3129		1980476	Laguna Negra orthohantavirus		12		12		
3130		1980481	Montano orthohantavirus	3		3			
3131		1980485	Prospect Hill orthohantavirus	1	2	1	2		
3132		1980486	Puumala orthohantavirus	32	20	32	20		
3133		1980489	Sangassou orthohantavirus		6		6		
3134		1980490	Seoul orthohantavirus		5		5		
3135		1980491	Sin Nombre orthohantavirus	1	35	1	35		
3136		1980494	Tula orthohantavirus	1	14	1	14		
3137		1980519	Crimean-Congo hemorrhagic fever orthonairovirus	20	2	82	18	62	16
3139	X	2043570	Zika virus ZIKV/H. sapiens/FrenchPolynesia/10087PF/2013				54		54
3140	X	2070132	Influenza A virus (A/chicken/Jiangsu/W1-8/2015(H7N9))			6		6	

3141		2116544	Synechococcus lacustris	1		1			
3142		2169971	Visna-maedi virus	5	7	5	7		
3143		2169986	Barley yellow dwarf virus PAV	1		1			
3144		2169991	Argentinian mammarenavirus	5	873	8	873	3	
3145		2169992	Brazilian mammarenavirus		879		879		
3146		2169993	Cali mammarenavirus		11		11		
3147		2169994	Paraguayan mammarenavirus		1		1		
3148		2169996	Serra do Navio mammarenavirus		3		3		
3149		10000000	Mus musculus BALB/c		3		3		
3150		10000055	Mus musculus DBA/2	1		1			
3151	X	10000067	Mus musculus C57BL/6				6005		6005
3152		10000187	Sus scrofa Landrace X Large White	1		1			
3153		10000291	Bacillus anthracis str. Sterne 34F2	1		1			
3154		10000293	Clostridium botulinum A 1	1		1			
3155		10000294	Clostridium botulinum A 2	2		2			
3156		10000295	Clostridium botulinum B 111	2		2			
3157		10000296	Clostridium botulinum D 1873	2		2			
3158		10000297	Clostridium botulinum C 92-13	5		5			
3159		10000299	Clostridium botulinum E Beluga	2		2			
3160		10000301	Clostridium botulinum A str. Hall hyper	3		3			
3161		10000302	Clostridium botulinum A Kyoto-F	1		1			
3162		10000303	Clostridium botulinum B Lammana	1		1			
3163		10000304	Clostridium botulinum F NCTC 10281	1		1			
3164		10000305	Clostridium botulinum B Okra	3		3			
3165		10000306	Clostridium botulinum C Stockholm	2		2			
3166		10000307	Clostridium difficile BART'S W1	1		1			
3167		10000308	Listeria monocytogenes ATCC 35967		1		1		
3168		10000309	Listeria monocytogenes ATCC 43251		3		3		
3169		10000313	Mycobacterium avium serovar 1	1		1			
3170		10000314	Mycobacterium avium serovar 2	1		1			
3171		10000316	Mycobacterium avium serovar 25	1		1			
3172		10000317	Mycobacterium avium serovar 26	1		1			
3173		10000318	Mycobacterium avium serovar 4	2		2			
3174		10000319	Mycobacterium avium serovar 8	1	1	1	1		
3175		10000320	Mycobacterium avium serovar 9	1		1			
3176		10000323	Mycobacterium bovis T/91/1378		6		6		
3177		10000328	Mycobacterium avium subsp. paratuberculosis Strain Ben		1		1		
3178		10000329	Mycobacterium tuberculosis 103	1		1			
3179		10000331	Mycobacterium gastri W471	1		1			
3180		10000335	Candida albicans A-9 (serotype B)	1		1			
3181		10000337	Candida albicans KIT 1113	1		1			
3182		10000339	Candida albicans serotype A	1		1			
3183		10000341	Leishmania donovani donovani 1S2D	1		1			
3184		10000345	Leishmania infantum LEM 75	14		14			
3185		10000348	Trypanosoma cruzi G	1		1			
3186		10000351	Trypanosoma cruzi Y	1		1			
3187		10000352	Entamoeba histolytica YS-27	1		1			
3188		10000353	Toxoplasma gondii 76K	5	5	5	5		
3189		10000354	Toxoplasma gondii BK	1	1	1	1		
3190		10000355	Toxoplasma gondii Prugniaud		1		1		
3191		10000356	Plasmodium berghei NK65	2	2	2	2		
3192		10000357	Plasmodium chabaudi adami DS	2	37	2	37		
3193		10000358	Plasmodium falciparum 366		1		1		
3197		10000363	Plasmodium falciparum Brazil-608	1	1	1	1		
3198		10000366	Plasmodium falciparum FCB-2	1		1			
3199		10000369	Plasmodium falciparum FVO		5		5		
3200		10000370	Plasmodium falciparum GAM5		1		1		
3201		10000371	Plasmodium falciparum Indochina I/CDC	32		32			
3202		10000373	Plasmodium falciparum ItG2G1		1		1		
3203		10000375	Plasmodium falciparum RO71	1	1	1	1		
3204		10000376	Plasmodium falciparum UF-5	2		2			
3205		10000378	Plasmodium vivax NK		2		2		
3206		10000381	Plasmodium yoelii yoelii YM	1	5	1	5		
3207		10000382	Babesia bovis Mexico	1	4	1	4		
3208		10000383	Babesia bovis Mexico Mo7	1	33	1	33		

3209		10000385	Schistosoma mansoni Puerto Rico	20	7	20	7		
3210		10000386	Monkeypox virus USA_2003_039		1		1		
3211		10000388	Vaccinia virus NYCBH - Dryvax		29		29		
3212		10000390	Variola major virus India-1967		1		1		
3213		10000391	Equid herpesvirus 2 ER32	1		1			
3214		10000394	Human herpesvirus 1 103/65	1		1			
3215		10000396	Human herpesvirus 1 McIntyre		1		1		
3216		10000398	Human herpesvirus 1 NS	1		1			
3217		10000404	Bovine herpesvirus 1 Lam	1		1			
3218		10000405	Equid herpesvirus 4 TH20	2		2			
3219		10000406	Human herpesvirus 3 H-551	26	15	26	15		
3220		10000408	Human herpesvirus 5 TB40		1		1		
3221		10000411	Murid herpesvirus 1 deltaMS94.5		2		2		
3222		10000412	Murid herpesvirus 1 Isolate G4		1		1		
3223		10000413	Murid herpesvirus 1 Isolate K6		1		1		
3225		10000420	Human herpesvirus 4 BL74		1		1		
3226		10000421	Human herpesvirus 4 CKL		10		10		
3227		10000424	Human herpesvirus 4 GD1		1	4	1	4	
3228		10000427	Human herpesvirus 4 type A		5		5		
3230		10000435	Hepatitis B virus genotype D		6		6		
3231		10000436	Hepatitis B virus subtype AY	7		7			
3232		10000437	Hepatitis B virus subtype AYR		1		1		
3233		10000438	Human parvovirus B19 genotype 1	1		1			
3234		10000439	Eastern equine encephalitis virus SV	8		8			
3235		10000440	Dengue virus type 1 Hawaii	29	22	29	22		
3236		10000442	Dengue virus type 3 CH53489		7		7		
3237		10000444	Japanese encephalitis virus CH2195LA	1		1			
3238		10000445	Japanese encephalitis virus JaOH0566	1		1			
3239		10000447	West Nile virus 3000.0259	2		2			
3240		10000449	Tick-borne encephalitis virus (WESTERN SUBTYPE) - Neudoerfl	10		10			
3241		10000451	Classical swine fever virus Shimen	16		16			
3242		10000453	Hepatitis C virus subtype 1a (isolate Gla)	5		5			
3243		10000455	Hepatitis C virus subtype 1a 1/910		18		18		
3244		10000456	Hepatitis C virus subtype 1b AD78	71		71			
3245		10000457	Hepatitis C virus subtype 1a Chiron Corp.	1	1	1	1		
3247		10000460	Hepatitis C virus subtype 1b JK1	13		13			
3248		10000462	Measles virus CAM/RB		1		1		
3249		10000463	Phocine distemper virus 2558/Han 88	5		5			
3250		10000465	Rinderpest virus LATC	2		2			
3251		10000467	Rabies virus CVS	14		14			
3252		10000470	Rabies virus Flury LEP		1		1		
3253		10000471	Rabies virus RC-HL	4		4			
3254		10000472	Bovine ephemeral fever virus BB7721	2		2			
3255		10000474	Influenza A virus H3N2 (A/Resvir-9 (H3N2))		10		10		
3256		10000477	H1N1 subtype Influenza A virus (A/Netherlands/306/00 (H1N1))		1		1		
3257		10000482	Rift Valley fever virus ZH501	2		2			
3258		10000483	Puumala virus CG18-20	4		4			
3259		10000484	Puumala virus Kazan	26	7	26	7		
3260		10000485	Puumala virus (STRAIN HALLNAS B1) Vranica/Hallnas	4		4			
3261		10000487	Lymphocytic choriomeningitis virus (strain Armstrong) (clone 4)	1		1			
3262		10000488	Lymphocytic choriomeningitis virus (strain Armstrong) (clone 53b)		61		61		
3263		10000490	Lymphocytic choriomeningitis virus A22.2b		1		1		
3264		10000491	Lymphocytic choriomeningitis virus Docile		2		2		
3265		10000494	Lymphocytic choriomeningitis virus (strain WE) variant 8.7		1		1		
3266		10000495	Lymphocytic choriomeningitis virus (strain WE) WE CL1.2		1		1		
3267		10000496	Lymphocytic choriomeningitis virus (strain Armstrong) (clone 3)		1		1		
3268		10000497	Lymphocytic choriomeningitis virus (strain Armstrong) (clone 5)	1		1			
3269		10000499	Equine infectious anemia virus PV		2		2		
3270		10000500	Human immunodeficiency virus 1 IIIB	1	2	1	2		

3271		10000501	Simian immunodeficiency virus - mac - mac 239		474		474		
3272		10000502	Simian immunodeficiency virus - mac - mac 32H		9		9		
3273		10000503	Simian immunodeficiency virus - mac - mac BK28		4		4		
3274		10000504	Simian immunodeficiency virus - mac - mac F965		2		2		
3276		10000506	Simian immunodeficiency virus - sm - sm PT573		3		3		
3277		10000507	Rabbit hemorrhagic disease virus Olot/89	1		1			
3278		10000513	Foot-and-mouth disease virus (strain O1) (O1 Kaufbeuren)	43	8	43	8		
3279		10000514	Foot-and-mouth disease virus (strain O1) (O1BFS 1860)	9		9			
3280		10000515	Foot-and-mouth disease virus (strain O1) (O1BFS)	5		5			
3281		10000516	Foot-and-mouth disease virus (strain O1) (O1 Campos)	18	19	18	19		
3282		10000518	Borna disease virus Giessen strain He/80	6		6			
3283		10000519	Hepatitis E virus China Xinjiang	1		1			
3284		10000520	Hepatitis E virus SAR-55	2	6	2	6		
3285		10000523	Hepatitis delta virus TW2667		5		5		
3286		10000524	Equid herpesvirus 2 691	1		1			
3287		10000525	Equid herpesvirus 2 16V	1		1			
3288		10000526	Equid herpesvirus 2 5FN	1		1			
3289		10000527	Equid herpesvirus 2 FIN60	1		1			
3290		10000528	Porcine respiratory and reproductive syndrome virus BJ-4	1		1			
3291		10000529	Porcine respiratory and reproductive syndrome virus CH-1a	7	1	7	1		
3292		10000530	Borrelia garinii IP90	3		3			
3293		10000535	Human herpesvirus 6B HST	1		1			
3294		10000536	Murid herpesvirus 4 G2.4		3		3		
3295		10000537	Murid herpesvirus 4 WUMS		19		19		
3296		10000542	Streptococcus pyogenes serotype M3 D58	4		4			
3297		10000544	Sin Nombre virus NM H10	4		4			
3298		10000547	Human enterovirus 71 Subgenogroup B5	12		12			
3299		10000548	Human enterovirus 71 Subgenogroup C2	19		19			
3300		10000549	Human enterovirus 71 Subgenogroup C4	11		11			
3301		10000550	Influenza A virus H3N2 (A/Netherlands/9/03 (H3N2))		1		1		
3302		10000553	Andes virus CHI-7913	53		53			
3303		10000554	Salmonella enterica subsp. enterica serovar Minnesota R595	2		2			
3304		10000555	Plasmodium yoelii yoelii 265BY		1		1		
3305		10000556	Foot-and-mouth disease virus (strain O1) Kaufbeuren	43	12	44	12	1	
3306		10000559	Chlamydophila abortus B-577	11		11			
3307		10000560	Norovirus genogroup 3 Bo/Jena/1980/DE	1		1			
3308		10000566	Paracoccidioides brasiliensis B339		8		8		
3309		10000567	Vibrio cholerae O1 serotype Inaba	1		1			
3310		10000568	Vibrio cholerae O1 serotype Ogawa	6		6			
3311		10000571	Cowpox virus (Brighton Red) White-pock		1		1		
3312		10000662	Rattus norvegicus Lewis		1		1		
3313		10000675	Borrelia burgdorferi CA12		6		6		
3314		10000679	Campylobacter jejuni subsp. jejuni 16971.94GSH (O:41)	2		2			
3315		10000718	Helicobacter pylori J223	2		2			
3316		10000720	Helicobacter pylori UA948	2		2			
3317		10000721	Helicobacter pylori UA955	1		1			
3318		10000723	Pseudomonas aeruginosa Immunotype 4	4		4			
3319		10000727	Escherichia coli 180/C3	1		1			
3320		10000728	Escherichia coli B B/r CM6		1		1		
3321		10000733	Escherichia coli O5:K4:H4	1		1			
3322		10000734	Escherichia coli O65:K-:H-	1		1			
3323		10000738	Salmonella typhimurium PL5 (O9,12)	1		1			
3324		10000739	Salmonella typhi 620Ty	1		1			
3325		10000740	Salmonella typhi Ty21a		6		6		
3326		10000742	Salmonella typhimurium SH 4809	4		4			
3327		10000743	Salmonella typhimurium SL3261		4		4		
3328		10000748	Shigella dysenteriae serotype 1	3		3			
3329		10000749	Shigella dysenteriae serotype 1 114Sd	1		1			
3330		10000752	Shigella flexneri 5b	1		1			
3331		10000754	Shigella flexneri X	1		1			
3332		10000756	Yersinia pestis KIM 5	21		21			
3333		10000757	Yersinia pestis 195/P	5		5			
3334		10000759	Pasteurella multocida X-73	2		2			

3335		10000760	Anaplasma marginale South Idaho		2		2		
3336		10000761	Orientia tsutsugamushi Karp	1		1			
3337		10000763	Chlamydia trachomatis Serovar C	16	1	16	1		
3338		10000764	Chlamydia trachomatis Serovar E	19	2	19	2		
3339		10000765	Chlamydia trachomatis Serovar H	7		7			
3340		10000766	Chlamydia trachomatis Serovar I	10		10			
3341		10000767	Chlamydia trachomatis serovar K	14		14			
3342		10000768	Chlamydia trachomatis Serovar L2	15	12	15	12		
3343		10000769	Chlamydia trachomatis Serovar L3	2		2			
3344		10000773	Streptococcus mutans MT 8148	40	12	40	12		
3345		10000775	Streptococcus pyogenes 156	1		1			
3346		10000776	Streptococcus pyogenes 88/25	1		1			
3347		10000777	Streptococcus pyogenes 88/30	1		1			
3348		10000778	Streptococcus pyogenes 88/544	1		1			
3349		10000779	Streptococcus pyogenes 90/85	1		1			
3350		10000780	Streptococcus pyogenes serotype M12 A374	1		1			
3351		10000781	Streptococcus pyogenes BSA10	3		3			
3352		10000782	Streptococcus pyogenes NS1	1		1			
3353		10000783	Streptococcus pyogenes NS14	1		1			
3354		10000784	Streptococcus pyogenes NS27	1		1			
3355		10000785	Streptococcus pyogenes NS5	1		1			
3356		10000786	Streptococcus pyogenes serotype M11	2		2			
3357		10000787	Streptococcus pyogenes serotype M13	1		1			
3358		10000788	Streptococcus pyogenes serotype M22	1		1			
3359		10000789	Streptococcus pyogenes serotype M24	6	2	6	2		
3360		10000790	Streptococcus pyogenes serotype M30	1		1			
3361		10000791	Streptococcus pyogenes serotype M41	1		1			
3362		10000792	Streptococcus pyogenes serotype M52	1		1			
3363		10000793	Streptococcus pyogenes serotype M54	1		1			
3364		10000794	Streptococcus pyogenes serotype M55	1		1			
3365		10000795	Streptococcus pyogenes serotype M57	1		1			
3366		10000796	Streptococcus pyogenes serotype M60	1		1			
3367		10000797	Streptococcus pyogenes serotype M75	1		1			
3368		10000798	Streptococcus pyogenes serotype M8	1		1			
3369		10000801	Foot-and-mouth disease virus - type O (O/SKR/2002)	1		1			
3370		10000802	Taenia crassiceps Strain ORF	3	3	3	3		
3371		10000804	Chlamydia trachomatis Serovar B	47	5	47	5		
3372		10000806	Foot-and-mouth disease virus (strain O1) (O1 Manisa)	5		5			
3373		10000807	Haemophilus influenzae NTHi UC19	2	2	2	2		
3374		10000809	Swine vesicular disease virus ITL/1/66	1		1			
3375		10000814	Leptospira interrogans serovar Lai str. HY-1	1		1			
3376		10000815	Pseudomonas aeruginosa PAO	2	2	2	2		
3377		10000816	Plasmodium falciparum T9/96	1	1	1	1		
3378		10000817	Pseudomonas aeruginosa KB7	2		2			
3379		10000818	Pseudomonas aeruginosa P1	1		1			
3380		10000820	Foot-and-mouth disease virus (strain O1) (O/Taiwan/1/97)	1		1			
3381		10000822	Pseudomonas aeruginosa Immunotype 3	1		1			
3382		10000824	Streptococcus pyogenes serotype M6 strain D471	4		4			
3383		10000825	Infectious bronchitis virus Avian strain D207	11		11			
3384		10000828	Ajellomyces dermatitidis ATCC 60636		2		2		
3385		10000829	Norovirus genogroup 2 Mexico type strain 36	3		3			
3386		10000832	Norovirus genogroup 2 Camberwell 1890	1		1			
3387		10000833	Haemophilus influenzae NTHi 1128	6		6			
3388		10000835	Equine rhinitis A virus 393/76	4		4			
3389		10000836	Foot-and-mouth disease virus C1 CS8	22	24	22	24		
3390		10000840	Foot-and-mouth disease virus C1 Brescia It/64	2		2			
3391		10000842	Swine vesicular disease virus NET/1/92	1		1			
3392		10000843	Neisseria meningitidis serogroup B H44/76	74	22	74	22		
3393		10000845	Chlamydia trachomatis Serovar F	3		3			
3394		10000848	Theileria sergenti Type B1		1		1		
3395		10000849	Theileria sergenti Type B2		2		2		
3396		10000850	Theileria sergenti Type C		5		5		
3397		10000851	Theileria sergenti Type I		1		1		
3398		10000852	Chlamydophila pneumoniae Kajaani 6		7		7		
3399		10000853	Chlamydia trachomatis Serovar L1	21	3	21	3		

3400		10000855	Theiler's murine encephalomyelitis virus (strain BeAn 8386) (variant M2)		1		1		
3401		10000856	Foot-and-mouth disease virus - type O isolate O/UKG/35/2001		14		14		
3403		10000858	Chlamydia trachomatis B/Jali-20/OT	2		2			
3404		10000859	Porcine respiratory and reproductive syndrome virus JA142	1		1			
3405		10000860	Haemophilus influenzae Serotype B	18	9	18	9		
3406		10000861	Haemophilus influenzae Variant d1	18		18			
3407		10000862	Plasmodium vivax VK247	1		1			
3408		10000863	Neisseria gonorrhoeae 4505	1		1			
3409		10000864	Porcine respiratory and reproductive syndrome virus MD-001	2		2			
3410		10000865	Influenza A virus H3N2 (A/Kiev/301/94)	3		3			
3411		10000888	Porcine respiratory and reproductive syndrome virus Olot/91	3	5	3	5		
3412		10000890	Porcine respiratory and reproductive syndrome virus SD92-23983		33		33		
3413		10000960	Human respiratory syncytial virus A Mon/3/88	6		6			
3414		10000961	Dengue virus type 1 strain 16007	15		15			
3415		10000964	Foot-and-mouth disease virus (strain O1) (O1 Brugge)	2		2			
3416		10000965	Dengue virus type 1 FGA/89	4		4			
3417		10000968	Hepatitis C virus subtype 1b isolate BE-11	3		3			
3418		10000969	Porcine respiratory and reproductive syndrome virus 111/92	9		9			
3419		10000971	West Nile virus NY-99	15	21	15	21		
3420		10000972	Neisseria meningitidis serogroup B Strain B16.B6	1		1			
3421		10000979	Neisseria meningitidis serogroup B Strain 8047	4		4			
3422		10000980	Arcanobacterium pyogenes Strain 42	4		4			
3423		10000986	Foot-and-mouth disease virus C1 CS30	1		1			
3424		10000987	Human rhinovirus 2 Vienna	5		5			
3425		10000989	Foot-and-mouth disease virus - type A (strain A22)	8	6	8	6		
3426		10000991	Foot-and-mouth disease virus - type A (strain A22 Iraq)	5	1	5	1		
3427		10000992	Foot-and-mouth disease virus - type SAT 1 (Strain Bot 1/68)	1		1			
3428		10000993	Foot-and-mouth disease virus - type SAT 2 (Strain Ken 3/57)	1		1			
3429		10000994	Foot-and-mouth disease virus - type SAT 3 (Strain Bec 1/65)	1		1			
3430		10000995	Foot-and-mouth disease virus - type Asia 1 Pakistan	1		1			
3431		10001000	Foot-and-mouth disease virus - type SAT 2 (strain Rho 1/48)	4		4			
3432		10001002	Swine vesicular disease virus SPA/1/93	16		16			
3433		10001003	Neisseria meningitidis serogroup B CU385	2		2			
3434		10001004	Human T-cell lymphotrophic virus type 1 (Caribbean isolate) (Strain HS35)	1		1			
3435		10001006	Proteus mirabilis CFT322	1		1			
3436		10001008	Chlamydia trachomatis Serovar J	6		6			
3437		10001019	Mus musculus B10.D2		1		1		
3438		10001020	Peste-des-petits-ruminants virus (strain Nigeria 75/1)		1		1		
3439		10001021	Treponema pallidum subsp. pallidum (strain Chicago)	19		19			
3440		10001025	Classical swine fever virus Glentorf		26		26		
3441		10001027	Vaccinia virus Connaught	1		1			
3442		10001028	Human poliovirus 2 (strain MEF-1)	1		1			
3443		10001032	Newcastle disease virus (strain La Sota)	1		1			
3444		10001039	Foot-and-mouth disease virus C3 (strain Resendne-Br/55)	1		1			
3445		10001040	Human poliovirus 2 (strain Sabin)	2	7	2	7		
3446		10001042	Haemophilus influenzae NTHi 1479	12	4	12	4		
3447		10001044	Neisseria meningitidis serogroup C MC51	1		1			
3448		10001047	West Nile virus strain 2741	32		32			
3449		10001049	Neisseria meningitidis serogroup B Strain S3446	1		1			
3450		10001050	Neisseria meningitidis serogroup B Strain 7967	1		1			
3451		10001051	Neisseria meningitidis serogroup A Strain 8659	1		1			
3452		10001053	Haemophilus influenzae MinnA	9		9			
3453		10001055	Haemophilus influenzae 6U	2		2			
3454		10001056	Haemophilus influenzae ATCC 9795	2		2			

3455		10001057	Pseudomonas aeruginosa CD4	1		1			
3456		10001058	Pseudomonas aeruginosa K122-4	1		1			
3457		10001077	Neisseria gonorrhoeae SU89	1		1			
3458		10001078	Neisseria gonorrhoeae SU96	3		3			
3459		10001081	Porphyromonas gingivalis HG66	2		2			
3460		10001085	Chlamydia trachomatis Serovar D	3		3			
3461		10001091	Borrelia burgdorferi BEP4	1		1			
3462		10001097	Sus scrofa Yorkshire	1		1			
3463		10001100	Plum pox virus (strain W)	6		6			
3464		10001102	Foot-and-mouth disease virus (strain O1) O/UKG/11/2001	1	1	1	1		
3465		10001116	Norovirus genogroup 1 isolates 96-908	4		4			
3466		10001118	Foot-and-mouth disease virus - type O (strain HKN/14/82)	2		2			
3467		10001120	Cryptococcus neoformans var. neoformans Serotype D	1		1			
3468		10001121	Chlamydia trachomatis Serovar Da	1		1			
3469		10001130	Feline leukemia virus subtype A	2		2			
3470		10001132	Cryptococcus neoformans var. neoformans Serotype A	1		1			
3471		10001133	Rattus norvegicus DA		3		3		
3472		10001138	Newcastle disease virus (strain Eaves)	1		1			
3473		10001140	Newcastle disease virus (strain WA2116)	1		1			
3474		10001141	Chlamydia trachomatis Serovar A	22	8	22	8		
3475		10001145	Escherichia coli 1471	2		2			
3476		10001149	Haemophilus influenzae Subtype 1H	23		23			
3477		10001150	Haemophilus influenzae Strain Eagan	58		58			
3478		10001154	Transmissible gastroenteritis virus MAD88	8	1	8	1		
3479		10001155	Haemophilus influenzae strain 1479	2		2			
3480		10001156	Hepatitis B virus subtype AD	3	2	3	2		
3481		10001157	H3N2 subtype Influenza A virus (A/Hong Kong(H3N2))		15		15		
3482		10001161	Neisseria meningitidis serogroup B Strain 2996	1		1			
3483		10001162	Neisseria meningitidis serogroup B Strain M1239	2		4		2	
3484		10001207	Murine leukemia virus LP-BM5		1		1		
3485		10001209	Tobacco mosaic virus (strain PM5)	1		1			
3486		10001210	Tobacco mosaic virus (strain Ni568)	1		1			
3487		10001213	Human coxsackievirus B3 (strain RK)	1		1			
3488		10001215	Human rotavirus G9 WI61	1		1			
3489		10001216	Rotavirus G3 strain RV-3	1		1			
3490		10001223	Porphyromonas gingivalis OMZ 409	23		23			
3491		10001225	H1N1 subtype Influenza A/Oklahoma/7485/01		5		5		
3492		10001238	Puumala virus (strain Umea/hu)	1		1			
3493		10001239	Porcine circovirus strain ISU31	7		7			
3494		10001243	Theileria parva strain Marikebuni		1		1		
3495		10001307	Small ruminant lentivirus strain It-561	1		1			
3496		10001308	Small ruminant lentivirus strain It-Pi1	1		1			
3497		10001315	H1N1 swine influenza virus (A/swine/Korea/S10/2004(H1N1))		3		3		
3498		10001316	H1N1 swine influenza virus (A/swine/Korea/S175/2004(H1N1))		1		1		
3499		10001317	H9N2 subtype Influenza A virus (A/swine/Korea/S81/2004(H9N2))		1		1		
3500		10001318	H9N2 subtype Influenza A virus (A/swine/Korea/S83/2004(H9N2))		2		2		
3501		10001335	Japanese encephalitis virus Vellore P20778	1	1	1	1		
3502		10001392	Human adenovirus B strain Harbin04B	5		5			
3503		10001396	Murine cytomegalovirus (strain Smith) MW97.01		5		5		
3504		10001412	Rattus norvegicus Wistar-Furth		11		11		
3505		10001424	Brucella abortus W99	1		1			
3506		10001431	Infectious bronchitis virus CK/CH/LDL/97I	1		1			
3507		10001439	Streptococcus sanguinis strain BD113-20		6		6		
3508		10001456	Human respiratory syncytial virus A strain RGH	1		1			
3509		10001459	Babesia bovis Argentina R1A	4		4			
3510		10001484	Norovirus genogroup 1 GI.12	1		1			
3511		10001485	Norovirus genogroup 3 GIII.1	1		1			
3512		10001489	Proteus vulgaris Strain 5/43	1		1			
3513		10001490	Proteus mirabilis O24	1		1			
3514		10001491	Proteus mirabilis O29	1		1			

3515		10001492	Salmonella enterica subsp. enterica serovar Enteritidis SH1262	3		3			
3517		10001498	Proteus mirabilis O23	1		1			
3518		10001499	Proteus mirabilis O6	1		1			
3519		10001500	Proteus mirabilis O43	1		1			
3520		10001501	Proteus penneri ATCC 33519	1		1			
3521		10001502	Escherichia coli J-5	1		1			
3522		10001503	Acinetobacter lwoffii F78	1		1			
3523		10001504	Yokenella regensburgei PCM 2476	1		1			
3524		10001505	Yokenella regensburgei PCM 2477	1		1			
3525		10001511	Salmonella 'group A'	2		2			
3526		10001514	Providencia stuartii O33	1		1			
3527		10001519	Pseudomonas aeruginosa serotype O11	1		1			
3528		10001520	Haemophilus influenzae strain RM7004	1		1			
3529		10001523	Haemophilus influenzae strain I-69 Rd-/b+	4		4			
3530		10001524	Neisseria meningitidis strain 3006	1		1			
3531		10001526	Salmonella thompson C1 strain IS40	1		1			
3532		10001528	Escherichia coli F515	1		1			
3533		10001530	Acinetobacter haemolyticus strain 57	1		1			
3534		10001531	Acinetobacter haemolyticus strain 61	1		1			
3535		10001556	Moraxella catarrhalis 26404	1		1			
3536		10001558	Neisseria gonorrhoeae 15253	1		1			
3537		10001560	Neisseria meningitidis M982B	2		2			
3538		10001569	Salmonella enterica subsp. enterica serovar Gallinarum/pullorum str. 11	1		1			
3539		10001570	Salmonella enterica subsp. enterica serovar Gallinarum/pullorum str. 77	1		1			
3540		10001573	Anatid herpesvirus 1 Clone-03	1		1			
3541		10001578	Classical swine fever virus LPC/AHRI	4		4			
3542		10001581	Proteus penneri 8 (O67)	1		1			
3543		10001582	Dengue virus 1 Mochizuki	4		4			
3544		10001583	Dengue virus 2 New Guinea C	1	4	1	4		
3545		10001586	Porcine reproductive and respiratory syndrome virus 07V063	3		3			
3546		10001587	Porcine reproductive and respiratory syndrome virus 08V204	2		2			
3547		10001588	Providencia stuartii O4	1		1			
3549		10001606	Norovirus genogroup 2 Hu/NoV/Farmington Hills/2002/USA	1	2	1	2		
3550		10001614	Junin virus strain MC2		1		1		
3551		10001615	Machupo virus strain Carvallo		1		1		
3552		10001616	Guanarito virus strain INH-95551		1		1		
3553		10001617	Whitewater Arroyo virus strain AV9310135		1		1		
3554		10001618	Pichinde virus strain Munchique		1		1		
3555		10001619	Dengue virus 3 strain 16652	16		16			
3556		10001624	Feline infectious peritonitis virus (strain KU-2)	22	43	22	43		
3557	X	10001627	Human herpesvirus 5 (strain RV798)				6		6
3558		10001628	Aggregatibacter actinomycetemcomitans serotype b str. Y4	1		1			
3559		10001633	Escherichia coli 055:B5	3		3			
3560		10001635	Dengue virus 2 PL046		7		7		
3561		10001636	Dengue virus 2 S221		42		42		
3562		10001638	Streptococcus pneumoniae type 27	2		2			
3563		10001641	Streptococcus dysgalactiae subsp. equisimilis D181	1		1			
3564		10001642	Foot-and-mouth disease virus - type O Wuppertal/FRG/82		1		1		
3565		10001644	Streptococcus pneumoniae CCUG 1378	1		1			
3566		10001645	Streptococcus pneumoniae CSR-SCS-2	1		1			
3567		10001646	Streptococcus pneumoniae type 37	2		2			
3568		10001648	Japanese encephalitis virus strain SA-14 -14-2	2		2			
3569		10001649	West Nile virus strain 956	1		1			
3570		10001651	Streptococcus pneumoniae type 14	19		19			
3571		10001652	Candida albicans NIH B-792 (serotype B)	1		1			
3572		10001659	Escherichia coli O125	1		1			
3573		10001662	Staphylococcus aureus Cowan 1	2		2			
3574		10001663	Streptococcus anginosus K214-2K	4		4			
3575		10001667	Helicobacter pylori 487	1		1			

3576		10001676	Streptococcus dysgalactiae subsp. equisimilis ATCC 12388	2		2			
3577		10001686	Streptococcus pneumoniae type 6A	2		2			
3578		10001687	Streptococcus pneumoniae type 6B	5		5			
3579		10001688	Pseudomonas syringae pv. atrofaciens str. IMV 7836	1		1			
3580		10001689	Pseudomonas syringae pv. atrofaciens str. IMV K-1025	1		1			
3581		10001690	Pseudomonas syringae pv. atrofaciens str. IMV 4394	1		1			
3582		10001693	Pseudomonas syringae pv. tagetis str. ICMP 6370	1		1			
3583		10001697	Pseudomonas syringae pv. phaseolicola str. IMV 120a	1		1			
3584		10001698	Pseudomonas syringae pv. morsprunorum str. GSPB 883	1		1			
3585		10001700	Pseudomonas syringae pv. morsprunorum str. CFBP 1650	1		1			
3586		10001705	Dengue virus 2 strain 43	1		1			
3587		10001713	Neisseria meningitidis serogroup W-135	1		1			
3588		10001722	Salmonella 'group D'	3		3			
3589		10001730	Streptococcus pneumoniae type 6C	1		1			
3590		10001731	Streptococcus pneumoniae type 2	8		8			
3592		10001740	Candida glabrata IFO 0622	1		1			
3593		10001747	Candida parapsilosis M1015	1		1			
3594		10001761	BK polyomavirus strain Dunlop		1		1		
3595		10001762	JC polyomavirus strain MAD1		1		1		
3596		10001763	Simian virus 40 strain 776		1		1		
3597		10001764	Classical swine fever virus Margarita (AJ704817)	4	1	4	1		
3598		10001768	Dengue virus 2 S-16803	1		1			
3599		10001771	Porcine reproductive and respiratory syndrome virus HuN4-F112	4	1	4	1		
3600		10001783	Neisseria meningitidis serogroup C strain C11	1	1	1	1		
3601		10001792	Streptococcus pneumoniae type 3	6		6			
3602		10001794	Helicobacter pylori B128 Gerbil-adapted variant 7.13	1		1			
3604		10001797	Neisseria meningitidis serogroup C strain MC19	1		1			
3605		10001798	Porcine transmissible gastroenteritis coronavirus strain Pur46-MAD	4		4			
3606		10001800	Porcine reproductive and respiratory syndrome virus HuN4	1	4	1	4		
3607	X	10001801	Streptococcus pneumoniae type 8			10		10	
3608		10001831	Moraxella catarrhalis serotype B	1		1			
3609		10001835	Proteus penneri 7 (O61)	2		2			
3610		10001836	Proteus penneri 14 (O59)	2		2			
3611		10001837	Proteus penneri 15 (O52)	2		2			
3612		10001847	Clostridium difficile BI / NAP1/ 027	1		1			
3613		10001849	Moraxella catarrhalis serotype A	3		3			
3614		10001851	Moraxella catarrhalis serotype C	1		1			
3615		10001860	Neisseria meningitidis serogroup X	3		3			
3616		10001879	West Nile virus strain 68856	2		2			
3617		10001881	Porcine circovirus 2 -A	3		3			
3619		10001886	Brucella ovis 020	2		2			
3620		10001887	Brucella ovis Reo 198	1		1			
3621		10001888	Brucella ovis 63/290	1		1			
3623		10001895	Yersinia pseudotuberculosis str. 32777		1		1		
3624		10001900	Streptococcus agalactiae serogroup III M781	1	1	1	1		
3625		10001902	Human enterovirus 71 NUH0083/SIN/08	4		4			
3626		10001913	Lactobacillus johnsonii JCM 1022	3		3			
3627		10001918	Muscovy duck reovirus S12	2		2			
3628		10001929	Equine rhinitis B virus 2 strain 313/75	5		5			
3629		10001930	Equine rhinitis B virus 3 isolate 2225AS	5		5			
3630		10001934	Chikungunya virus Singapore/11/2008	3		3			
3631		10001943	Dengue virus 4 Burma/63632/1976	3		3			
3632		10001944	Dengue virus 3 Thailand/PaH881/1988	2		2			
3633		10001945	Dengue virus 1 PVP159	2		2			
3634		10001946	Foot-and-mouth disease virus - type Asia 1 YS/CHA/05	4		4			
3635		10001964	Porcine circovirus 1 strain 1/G	7		7			
3636		10001965	Avian leukosis virus strain NX0101	1		1			
3637		10001967	Avian leukosis virus isolate CAUHM01	1		1			
3638		10001973	Vaccinia virus Acambis 2000	8		8			
3639		10001975	Streptococcus salivarius JCM 5707	1		1			

3640		10001997	Chikungunya virus strain LR2006_OPY1 IMT/Reunion Island/2006	1		1			
3641		10001999	Reticuloendotheliosis virus strain HLJ07I	1		1			
3642		10002000	Porcine epidemic diarrhea virus CH/SHH/06	1		1			
3643		10002003	Campylobacter jejuni subsp. jejuni serotype HS:15	1		1			
3644		10002006	Bluetongue virus 16 BN96/16	2		2			
3645		10002007	Plasmodium falciparum isolate UAS22	4		4			
3646		10002008	Plasmodium falciparum isolate UAS31	1		1			
3647		10002009	Plasmodium falciparum isolate UAS29	2		2			
3648		10002010	Dengue virus 2 D2/SG/05K4155DK1/2005		49		49		
3649		10002011	Plasmodium falciparum R29/IT4	1		1			
3650		10002015	Human coxsackievirus A16 shzh05-1	92		92			
3651		10002018	Bovine coronavirus Kakegawa	1		1			
3652		10002020	Foot-and-mouth disease virus - type Asia 1 Nepal 29/97	4		4			
3653		10002022	Escherichia coli O6 O6:K15:H31		1		1		
3654		10002026	Murine norovirus 1 Mu/NoV/GV/MNV1/2002/USA		1		1		
3655		10002027	Bluetongue virus 16 Kumamoto/1985	2		2			
3656		10002028	Bluetongue virus 16 Beatrice Hill/1987	2		2			
3657		10002034	Fish	4		4			
3658		10002052	Toxoplasma gondii Gansu Jingtai	27		27			
3659		10002056	Enterovirus A71 TW/2086/98	1		1			
3660		10002069	Bordetella pertussis 509		7		7		
3661		10002079	Clostridium difficile VPI 10463	2		2			
3662		10002082	Rhesus rotavirus MMU 18006		3		3		
3663		10002089	Porcine reproductive and respiratory syndrome virus SY0608	17		17			
3664		10002090	Influenza A virus (A/swine/Denmark/101310-1/2011(H1N1))		7		7		
3665		10002111	Dengue virus 4 TVP-376	1		1			
3666		10002112	Dengue virus 4 1036	1		1			
3667		10002121	Staphylococcus aureus Reynolds	2		2			
3668		10002122	Staphylococcus aureus Becker	2		2			
3669		10002123	Peste-des-petits-ruminants virus China/Tibet/Geg/07-30	53		53			
3670		10002127	Escherichia coli O86:B7	1		1			
3671		10002129	Staphylococcus aureus RN4850	1		1			
3672		10002132	Duck hepatitis A virus 1 HP-1	2		2			
3673		10002148	Dengue virus 4 Mexico/BC287/1997	1		1			
3674		10002151	Duck hepatitis A virus 1 LY0801	1		1			
3675		10002152	Duck hepatitis A virus 3 SD1201	1		1			
3676	X	10002161	Streptococcus pneumoniae type 1			5		5	
3677		10002165	Avian infectious bronchitis virus (strain CHINA/Sczy3/09)	2		2			
3678		10002169	Avian infectious bronchitis virus (strain Holte)		2		2		
3680		10002183	ZIKV/H. sapiens/French Polynesia/PF13/2013	4		4			
3681	X	10002190	ZIKV/H. sapiens/Uganda/MR-766/1947			4		4	
3682		10002192	Streptococcus suis 1178027	2		2			
3684		10002196	Hepatitis E virus type 4 JAK-Sai	1		1			
3685		10002197	Chikungunya virus MY/08/065	15		15			
3687		10002238	Influenza A virus (A/swan/Poland/305-135V08/2006(H5N1))	1		1			
3688	X	10002272	Streptococcus pneumoniae 7F			5		5	
3689	X	10002273	Influenza A virus (A/Hong Kong/4801/2014(H3N2))				1		1
			Total	44803	388409	50408	461207	5605	72798

2 Website Features

There were two major releases (Releases 3.9 and 3.10) of the IEDB external website since the 2017 Annual Compendium plus numerous smaller updates made throughout the year. Changes of note include:

- A new popup export button was added to allow more export choices and format variants in the CSV export interface.
- Auto-complete for source antigens were also revised with new logic to sort by the most useful hits.
- In order to better manage and display receptor data, the underlying receptor database tables were completely redesigned and the web pages re-factored.
- The assay details page was refined to add a new collapsible table displaying detailed receptor information.

Although the major releases primarily focused on enhancing export options and improving receptor data logic and reporting, many outstanding bugs and refinements were also addressed throughout the contract year.

In addition, there were two major releases (Releases 2.19 and 2.20) of the Analysis Resource since the 2017 Annual Compendium plus numerous smaller updates made throughout the year. Changes of note include:

- Integration of netMHCpan 4.0
- Integration of BepiPred 2.0
- Introduction of length-rescaling for class I and II binding predictors
- Overhaul to the class I automated benchmarks
- Improved email notifications for many tools
- Transitioning of the code repositories from Trac/SVN to Gitlab/Git.
- Release of Standalone Immunome Browser tool that allows users to map epitope sequences to proteins and visualize assay data
- Release of MHC II NP tool for the prediction of naturally processed MHC II ligands
- Update of many backend libraries

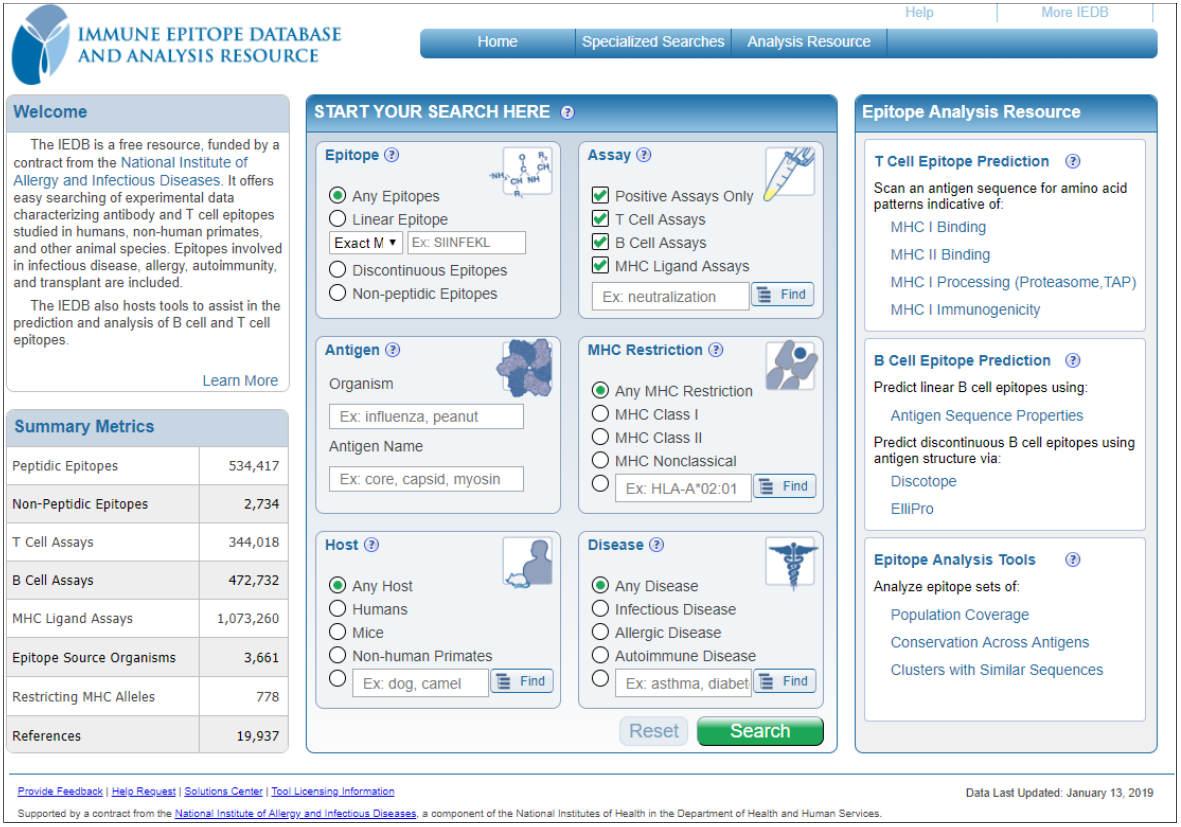
The IEDB website functionality can be divided into five categories– Home Page (Section 2.1), Specialized Searches (Section 2.2.2), Analysis Resource (Section 2.3), Help (Section 2.4), and More IEDB (Section 2.5), which largely correspond to the pull-down menus at the top of the home page. The subsections that follow describe the website features within these categories.

The reader will find it helpful to keep in mind how data are stored in the IEDB. Each item contained in the IEDB consists of a reference (article or submission) containing information about one or more epitopes and associated binding or response information. The same epitope can exist in multiple references.

2.1 Home Page

The IEDB Home Page (www.iedb.org) is the default screen displayed when users enter the IEDB system. Besides providing a general description of the IEDB project, the home page displays system level status and notification of scheduled updates or maintenance. As one can see in Figure 2.1, the page is divided into three columns that contain introductory information, Summary Metrics of the data, a basic data search capability, and links to the epitope prediction and analysis tools in the Analysis Resource. As users browse the IEDB system, they can return to the home page anytime by clicking *Home* on the far left of the main menu bar or by clicking on the IEDB logo in the upper left-hand corner of the page.

The top box in the left column contains a welcome statement that briefly describes the content of the database. It also has a "Learn More" link that brings the user to a web page containing more information about the support and user help features available, about the data itself, and about the IEDB program. This page is described in detail in Section 2.6. The Summary Metrics are displayed in the bottom box of this column. These numbers are intended to be a gauge of the volume of data available in the system. The Summary Metrics provide the number of epitopes (peptidic and non-peptidic), assays (T cell, B cell, and MHC ligand assays), epitope source organisms, restricting MHC alleles, and references. A middle box may appear when there are special messages to convey to users. The text will appear in red. The middle column contains the initial search interface that is described in detail in Section 2.2.1. This section includes several finders on the search interface, thus enabling more complete queries without the need for further filtering of the results. The rightmost column has links to the most frequently used tools in the Analysis Resource.



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 the prediction and analysis of B cell and T cell epitopes.

Summary Metrics

Peptidic Epitopes	534,417
Non-Peptidic Epitopes	2,734
T Cell Assays	344,018
B Cell Assays	472,732
MHC Ligand Assays	1,073,260
Epitope Source Organisms	3,661
Restricting MHC Alleles	778
References	19,937

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, diabet

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

Provide Feedback | Help Request | Solutions Center | Tool Licensing Information

Data Last Updated: January 13, 2019

Supported by a contract from the National Institute of Allergy and Infectious Diseases, a component of the National Institutes of Health in the Department of Health and Human Services.

Figure 2.1 IEDB 3.10 Home page

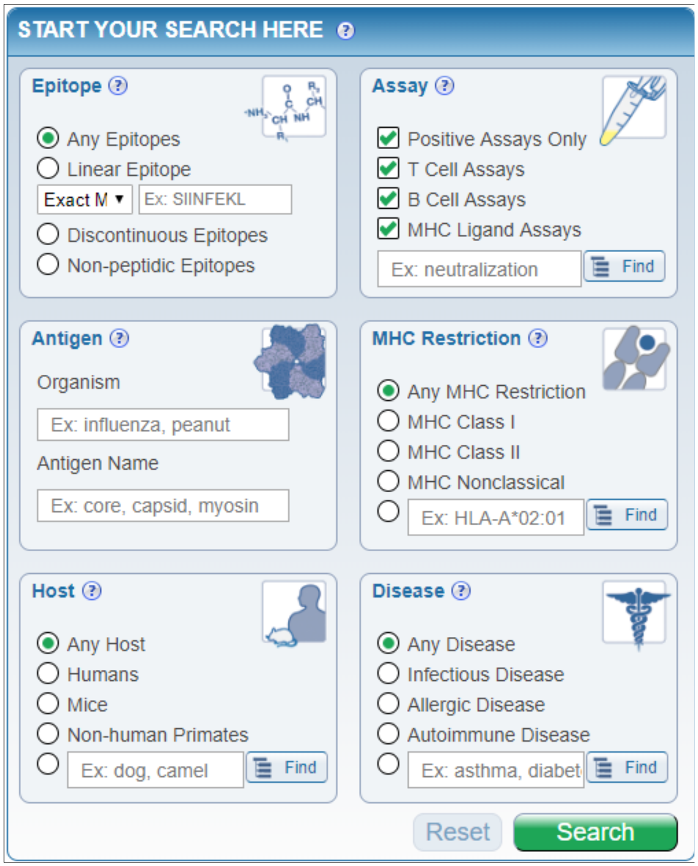
2.2 Query

There are several ways users can find information in the IEDB. A simplified search that is especially designed for the needs of most immunologists appears on the home page. This document will refer to this particular query as the Simple Search or Home Page Search. A family of advanced query-by-example searches can be accessed on the Search pull-down menu and consist of “Epitope Details”, “T Cell Assay Details”, “B Cell Assay Details”, “MHC Assay Details”, “Identifier Search”, and “Browse by 3D Structure”. This group of queries are referred to as Specialized Searches. All of these methods return results in a common format, as described in Section 2.2.3. These methods are elaborated in the subsections below.

2.2.1 Perform a Home Page Search

The home page search feature available in the center of the home page (Figure 2.2) is designed to simplify the search process for many commonly asked queries by immunologists. It is the most frequently used query mode. The approach it takes is analogous to many travel and shopping websites. IEDB users can start their search by specifying a number of fundamental and common search parameters on the home page. On the subsequent results page, users can then apply additional and more specific filters. The epitope structure choices include linear epitopes, discontinuous epitopes, and non-peptidic epitopes. For the linear epitope search, the user can prescribe the type of search desired - an exact match to the entered sequence, a substring search (described below), or a homologous peptides at sequence at identity levels of 70%, 80%, or 90% as determined by BLAST. The IEDB categorizes all assays as T cell, B cell, or MHC ligand. The MHC ligand includes binding and elution assays. Users can also select the MHC restriction for non-B cell searches. Finally, users can select the host species and the disease.

The results of the query are displayed in five tabs – Epitopes, Antigens, Assays, Receptors, and References. The Epitopes tab lists the epitope description, such as the amino acid sequence for linear epitopes, its associated antigen and source organism, the number of references in which it appears, and the number of assays in which it is used. The Antigen tab lists the antigen, its source organism, and the number of related epitopes, assays, and references. The Assays tab contains three tabs, one each for T cell, B cell, and MHC ligand assays. The Receptors tab details the receptor types alongside the sequences of each chain component, and is divided into two separate tabs for T Cell Receptors (TCRs) and B Cell Receptors (BCRs). The References tab lists the IEDB-specific reference identifier, the authors, title, abstract, and year of publication or submission. A user can cross-query specific criteria from any of these five tabs; for example, filtering on a specific assay would refresh the results to display data across all tabs which is only relevant to that assay. Additionally, a user can click on the IEDB-specific identifier link to drill down to get additional information about the epitope, assay, receptor or reference.


START YOUR SEARCH HERE

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 Find

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

MHC Restriction
● Any MHC Restriction
○ MHC Class I
○ MHC Class II
○ MHC Nonclassical
○ Ex: HLA-A*02:01 Find

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

Disease
● Any Disease
○ Infectious Disease
○ Allergic Disease
○ Autoimmune Disease
○ Ex: asthma, diabet Find

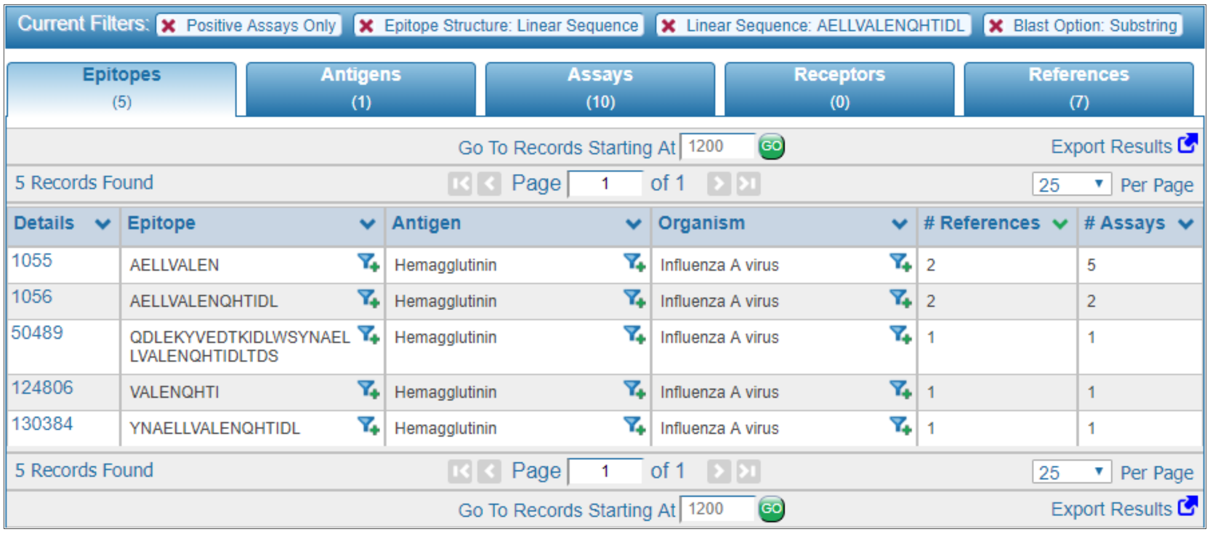
Figure 2.2 Home page simple search

Once the initial results are generated, the user can filter the results using additional filtering criteria. Auto-complete fields and associated hierarchical tree views reveal the available parameter choices. In this way, users can narrow their query to specific non-peptidic epitopes, assay types, MHC alleles, hosts, or diseases. Users can also specify article type (journal article and/or submission), the author, title, PubMed ID, and year. All filters that are applied are displayed at the top of the page. Results on most pages can be downloaded as comma separated value (CSV) files that can be read using a text editor or spreadsheet application. Users also have the ability to map positive and negative results to reference proteomes as a means of visualizing immunogenic regions using the Immunome Browser (Section 2.2.3.2).

An autocomplete feature is available for many of the fields on the lefthand side of the results page that contain additional filter criteria. This includes the non-peptidic epitope field in the Epitope box, the organism and antigen name fields in the Antigen box, the T cell, B cell, and MHC ligand assay fields in the Assay box, the specific MHC restriction field in the MHC Restriction box, the specific host field in the Host box, and the specific disease field in the Disease box. For example, as one types “hep” in the organism field in the Antigen box, several choices start to appear in a list below the text field, including “hepatitis C virus”. The user can click on a selection from the list or can continue typing to further narrow down choices. Likewise, a user may type “human” or “homo” to select “homo sapiens” in the Organism field. The list of matches includes scientific names and synonyms. These actions enable users to quickly specify their search parameters without using the finders. Use of the autocomplete circumvents the need to directly use the finders.

If the user decides not to use the autocomplete feature for a search field, they will need to use the finders. The epitope source can be prescribed for the source organism and source antigen by using the organism finder (Section 2.2.4.5) and molecule finder (Section 2.2.4.4), respectively. The user can decide whether to include B cell responses, T cell responses, and/or MHC ligand results in the search (at least one must be checked). The host organism, the MHC restriction, and the MHC class can also be specified with the help of the organism finder and the allele finder (Section 2.2.4.1). The fields using finders will allow multiple selections as search criteria. In these cases the selections are treated as a set. Records will be considered a match if they include at least one of the selected values in the set. The search is executed by clicking the Search button and the query results can be viewed on the updated results page described in Section 2.2.3.

In addition to finding peptides in the database that contain the specified amino acid sequence, the substring search also finds epitopes within the input sequence itself. For example, when the sequence AELLVALENQHTIDL is submitted for a substring search, the query results, shown in Figure 2.3, yields five peptide sequences. Three of them (the second, third, and fifth) contain the input sequence. The two others (the first and fourth) are substrings of the input sequence that are also epitopes contained in the IEDB.


Current Filters: ✖ Positive Assays Only ✖ Epitope Structure: Linear Sequence ✖ Linear Sequence: AELLVALENQHTIDL ✖ Blast Option: Substring

5 Records Found

Details	Epitope	Antigen	Organism	# References	# Assays
1055	AELLVALEN	Hemagglutinin	Influenza A virus	2	5
1056	AELLVALENQHTIDL	Hemagglutinin	Influenza A virus	2	2
50489	QDLEKYVEDTKIDLWSYNAEL LVALENQHTIDLTDS	Hemagglutinin	Influenza A virus	1	1
124806	VALENQHTI	Hemagglutinin	Influenza A virus	1	1
130384	YNAELLVALENQHTIDL	Hemagglutinin	Influenza A virus	1	1

5 Records Found

Figure 2.3 Query results for a substring search performed on the input sequence AELLVALENQHTIDL

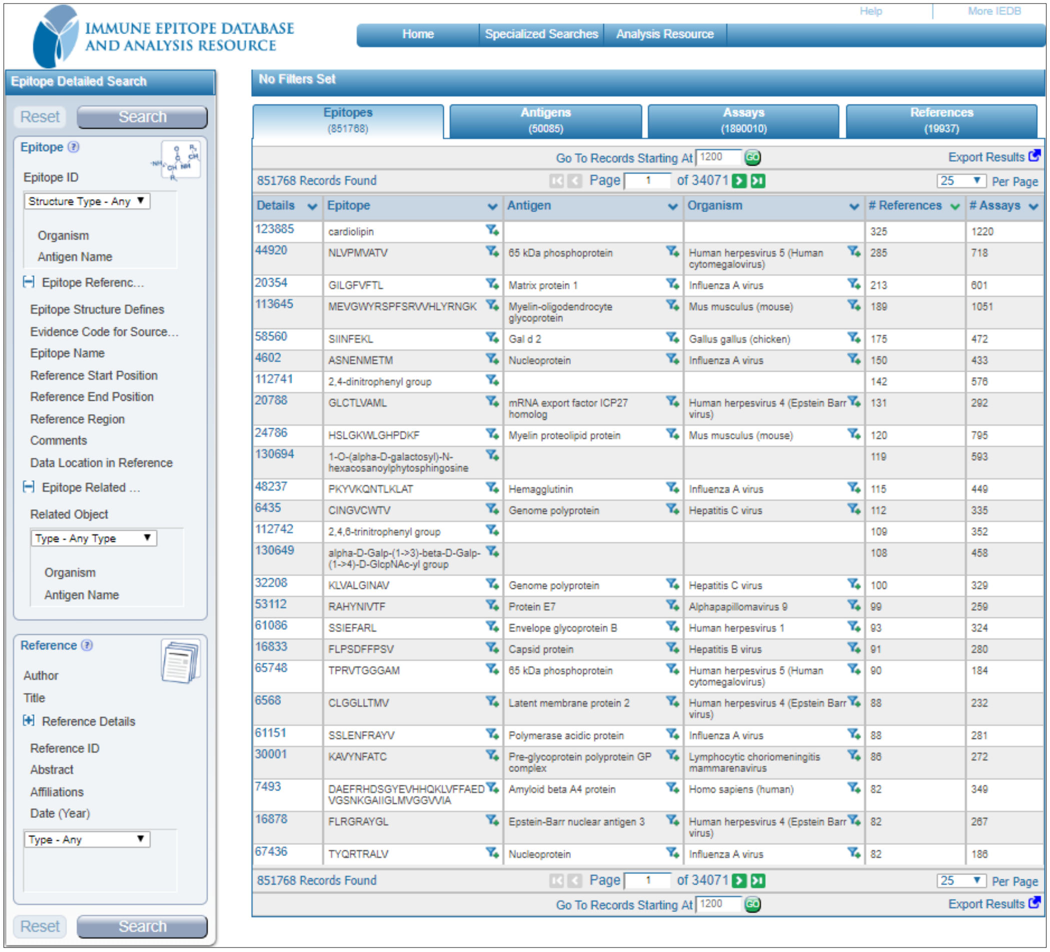
2.2.2 Specialized Searches

The Specialized queries are based on a standard Query by Example (QBE) approach, which is a method of forming queries where a user can enter conditions for each data field they want included in the query. The Specialized queries allow users to define example criteria for each field in the system. As there are over 300 fields, the Specialized Search queries are both powerful and comprehensive.

The fully expanded input screen for the Epitope Details Search is shown in Figure 2.4. The user can specify criteria in the left-hand panels for Epitope and Reference. These sections expand to the right to expose more detailed criteria for the search, including autocomplete fields and finders. An example of the expanded Epitope box is found in Figure 2.5. Users can specify search criteria for the epitope, such as epitope type (e.g. peptide from protein, carbohydrate), source molecule and organism, and various reference details. Further explanation of the search terms can be found in the Curation Manual. Using the bottom Reference section, the user can search on several reference criteria, such as author name, article title, the IEDB Reference ID, keywords in the reference abstract, year, author affiliation, and reference type. References are either published literature articles that have been curated by the IEDB curation staff or data submitted directly by researchers.

Auto-complete functionality is available for all the finder fields, as exemplified by the Simple Search and denoted by the greyed text that provide example inputs. The "?" provides a brief explanation and a "Learn More" link that connects to the appropriate help page in the IEDB Solutions Center. Finders are described in further detail in Section 2.2.4.

Figure 2.5 shows the fields when "Structure Type - Any" is selected in the Epitope filter. The fields for the other epitope type selections are shown in Figure 2.6 (linear epitopes), Figure 2.7 (Discontinuous epitopes), Figure 2.8 (Discontinuous peptides on Multichain), and Figure 2.9 (Non-peptidic epitopes).

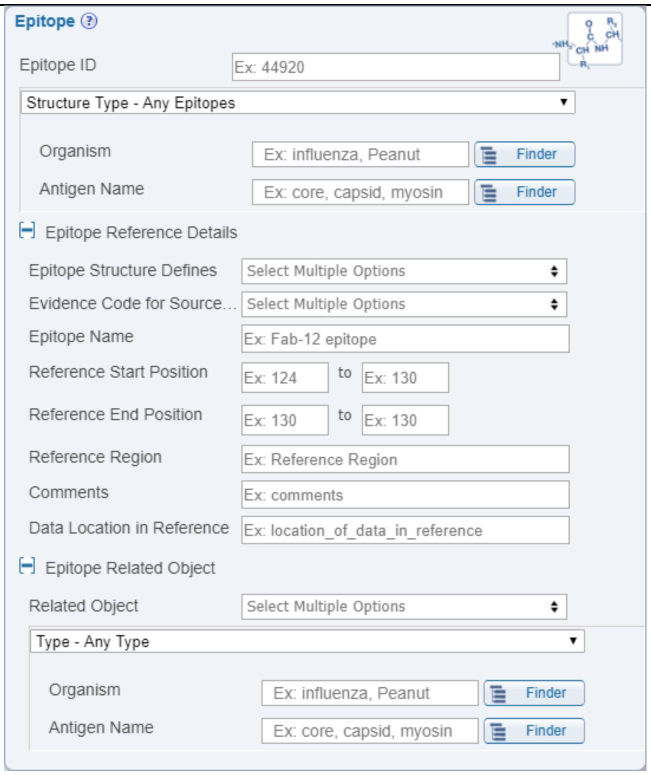


851768 Records Found

Details	Epitope	Antigen	Organism	# References	# Assays
123885	cardiolipin			325	1220
44920	NLVPMVATV	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)	285	718
20354	GILGFVFTL	Matrix protein 1	Influenza A virus	213	601
113645	MEVGWYRSPFSRVVHLYRNGK	Myelin-oligodendrocyte glycoprotein	Mus musculus (mouse)	189	1051
58560	SIINFEKL	Gal d 2	Gallus gallus (chicken)	175	472
4602	ASNENMETM	Nucleoprotein	Influenza A virus	150	433
112741	2,4-dinitrophenyl group			142	576
20788	GLCTLVAML	mRNA export factor ICP27 homolog	Human herpesvirus 4 (Epstein Barr virus)	131	292
24786	HSLGKWLGHPDKF	Myelin proteolipid protein	Mus musculus (mouse)	120	795
130694	1-O-(alpha-D-galactosyl)-N-hexacosanoylphytosphingosine			119	593
48237	PKYVKQNTLKLAT	Hemagglutinin	Influenza A virus	115	449
6435	CINGVCWTV	Genome polyprotein	Hepatitis C virus	112	335
112742	2,4,6-trinitrophenyl group			109	352
130649	alpha-D-Galp-(1->3)-beta-D-Galp-(1->4)-D-GlcpNAc-yl group			108	458
32208	KLVALGINAV	Genome polyprotein	Hepatitis C virus	100	329
53112	RAHYNIVTF	Protein E7	Alphapapillomavirus 9	99	259
61086	SSIEFARL	Envelope glycoprotein B	Human herpesvirus 1	93	324
16833	FLPSDFFPSV	Capsid protein	Hepatitis B virus	91	280
65748	TPRVTGGGAM	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)	90	184
6568	CLGGLLTMV	Latent membrane protein 2	Human herpesvirus 4 (Epstein Barr virus)	88	232
61151	SSLENFRAYV	Polymerase acidic protein	Influenza A virus	88	281
30001	KAVYNFATC	Pre-glycoprotein polyprotein GP complex	Lymphocytic choriomeningitis mammarenavirus	86	272
7493	DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA	Amyloid beta A4 protein	Homo sapiens (human)	82	349
16878	FLRGRAYGL	Epstein-Barr nuclear antigen 3	Human herpesvirus 4 (Epstein Barr virus)	82	267
67436	TYQRTRALV	Nucleoprotein	Influenza A virus	82	186

851768 Records Found

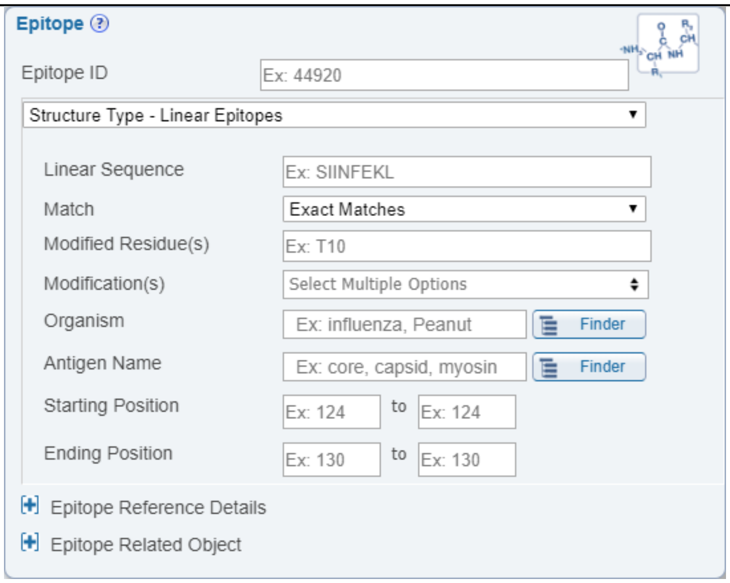
Figure 2.4 Epitope Detail Search input screen



Structure Type - Any Epitopes

Type - Any Type

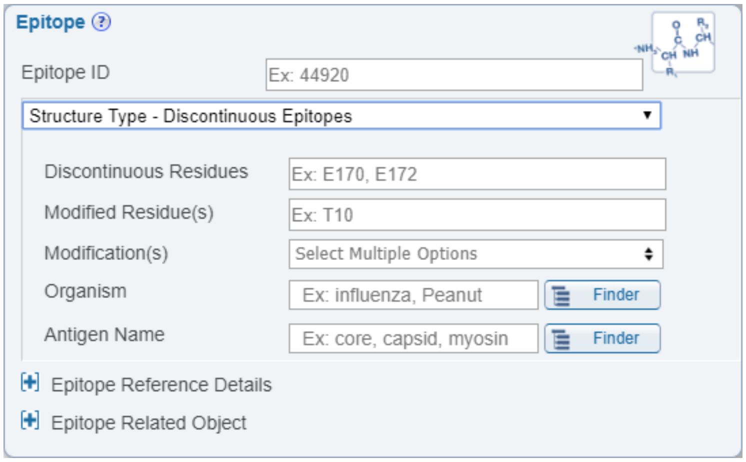
Figure 2.5 Epitope panel on the Specialized Search page expanded to show input fields



Structure Type - Linear Epitopes

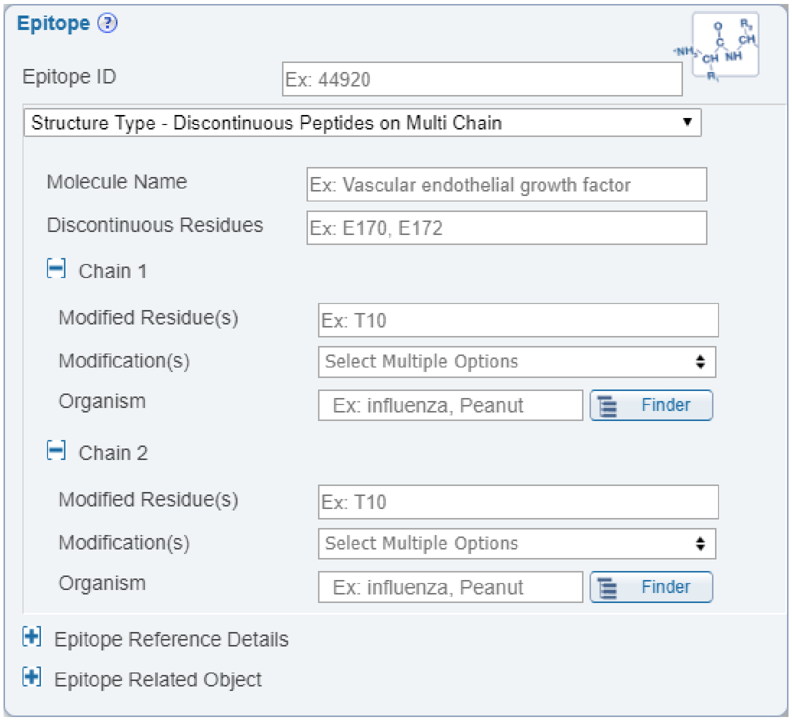
Match: Exact Matches

Figure 2.6 Epitope query fields in the Advanced Search for Linear peptide epitopes



Structure Type - Discontinuous Epitopes

Figure 2.7 Epitope query fields in the Advanced Search for Discontinuous peptide epitopes



Structure Type - Discontinuous Peptides on Multi Chain

Figure 2.8 Epitope query fields in the Advanced Search for Discontinuous peptide on multi-chain epitopes

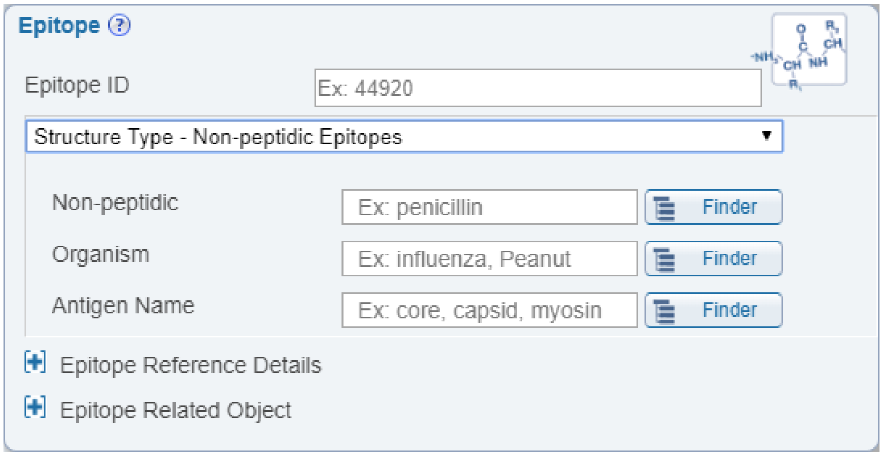
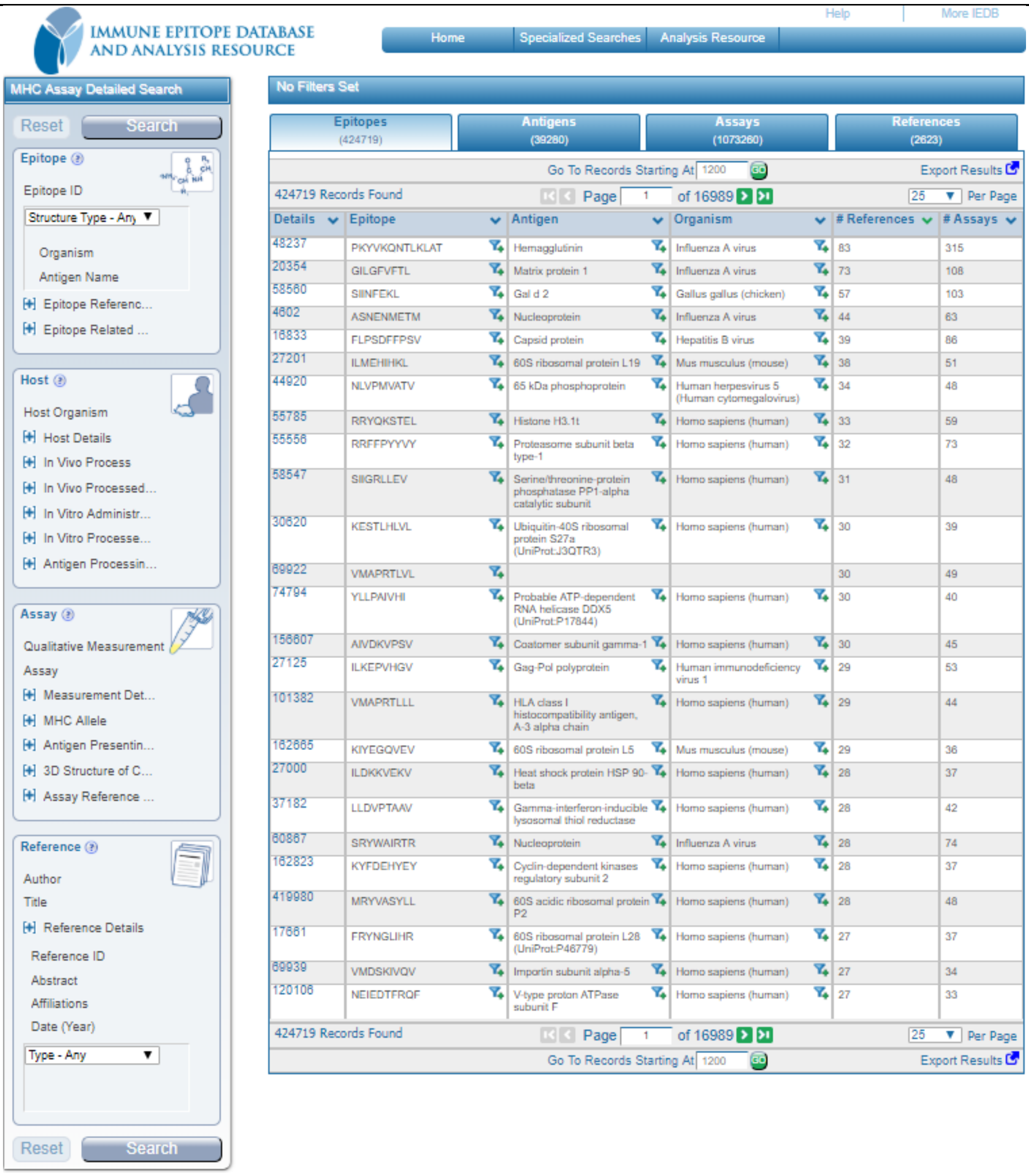


Figure 2.9 Epitope query fields in the Advanced Search for Non-peptidic epitopes

There are five other Specialized Search queries that can be used to select search criteria for references, epitopes, and assays. These are T Cell Assay Details, B Cell Assay Details, MHC Assay Details, Identifier Search, and Browse by 3D Structure. As an example, the MHC Assay Detailed Search page is shown in Figure 2.10. As is the case for all three assay search pages, the Epitope and Reference criteria fields are listed first and last, respectively, with the other relevant filter criteria specific for each assay type listed between them.



424719 Records Found

Details	Epitope	Antigen	Organism	# References	# Assays
48237	PKYVKQNTLKLAT	Hemagglutinin	Influenza A virus	83	315
20354	GILGFVFTL	Matrix protein 1	Influenza A virus	73	108
58560	SIINFEKL	Gal d 2	Gallus gallus (chicken)	57	103
4602	ASNENMETM	Nucleoprotein	Influenza A virus	44	63
16833	FLPSDFFPSV	Capsid protein	Hepatitis B virus	39	86
27201	ILMEHIHKL	60S ribosomal protein L19	Mus musculus (mouse)	38	51
44920	NLVPMVATV	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)	34	48
55785	RRYQKSTEL	Histone H3.1t	Homo sapiens (human)	33	59
55556	RRFFPYYVY	Proteasome subunit beta type-1	Homo sapiens (human)	32	73
58547	SIIGRLLEV	Serine/threonine-protein phosphatase PP1-alpha catalytic subunit	Homo sapiens (human)	31	48
30620	KESTLHLVL	Ubiquitin-40S ribosomal protein S27a (UniProt:J3QTR3)	Homo sapiens (human)	30	39
69922	VMAPRTLVL			30	49
74794	YLLPAIVHI	Probable ATP-dependent RNA helicase DDX5 (UniProt:P17844)	Homo sapiens (human)	30	40
156607	AIVDKVPSV	Coatomer subunit gamma-1	Homo sapiens (human)	30	45
27125	ILKEPVHGV	Gag-Pol polyprotein	Human immunodeficiency virus 1	29	53
101382	VMAPRTLLL	HLA class I histocompatibility antigen, A-3 alpha chain	Homo sapiens (human)	29	44
162665	KIYEGQVEV	60S ribosomal protein L5	Mus musculus (mouse)	29	36
27000	ILDKKVEKV	Heat shock protein HSP 90-beta	Homo sapiens (human)	28	37
37182	LLDVPTAAV	Gamma-interferon-inducible lysosomal thiol reductase	Homo sapiens (human)	28	42
60867	SRYWAIRTR	Nucleoprotein	Influenza A virus	28	74
162823	KYFDEHYEY	Cyclin-dependent kinases regulatory subunit 2	Homo sapiens (human)	28	37
419980	MRYVASYLL	60S acidic ribosomal protein P2	Homo sapiens (human)	28	48
17661	FRYNGLIHR	60S ribosomal protein L28 (UniProt:P46779)	Homo sapiens (human)	27	37
69939	VMDSKIVQV	Importin subunit alpha-5	Homo sapiens (human)	27	34
120106	NEIEDTFRQF	V-type proton ATPase subunit F	Homo sapiens (human)	27	33

424719 Records Found

Figure 2.10 MHC Assay Detailed Search web page

The B cell response assay category captures B cell-mediated immunity information and describes antibody responses related to the epitope/antigen. In a B cell response, B lymphocytes (a type of white blood cell) produce proteins called antibodies that bind to antigens. Antibodies are present on the surface on B lymphocytes and are also secreted. Once an antibody binds an antigen, the bound antigen molecule can be engulfed by phagocytes and broken into fragments.

The T Cell Response assay category captures T cell-mediated immunity information where the MHC molecule/antigen complex is recognized by T cells in the context of presentation by an antigen presenting cell.

The MHC Ligand assay category combines assays that were previously in the MHC Binding and MHC Ligand Elution assay categories. As such, the MHC Ligand category captures details relating to the in vitro interaction of the epitope with specific MHC molecules along with available Epitope-MHC complex structure details, that is the epitope's binding capacity to the MHC molecule. It also captures data related to epitopes that are naturally processed and presented on the surface of an antigen presenting cell. The MHC Ligand Elution subcategory differs from the MHC Binding subcategory in that for the former, antigen bound to the MHC molecule on the cell surface has been taken up and processed internally for presentation by the antigen presenting cell, where as for the latter, antigen in solution is bound to MHC molecules on the surface of the antigen presenting cells.

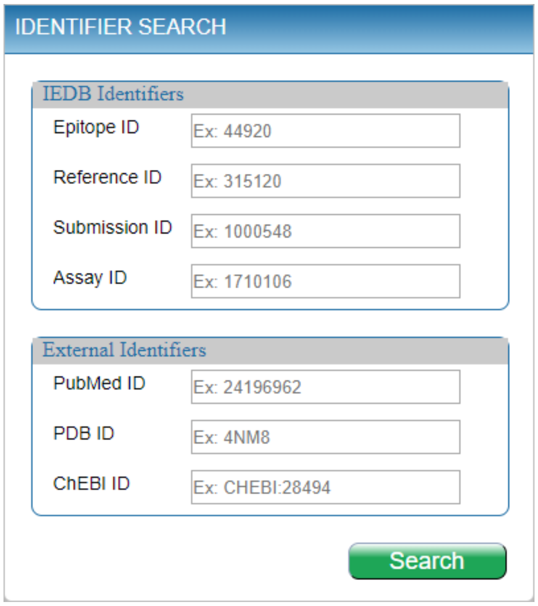
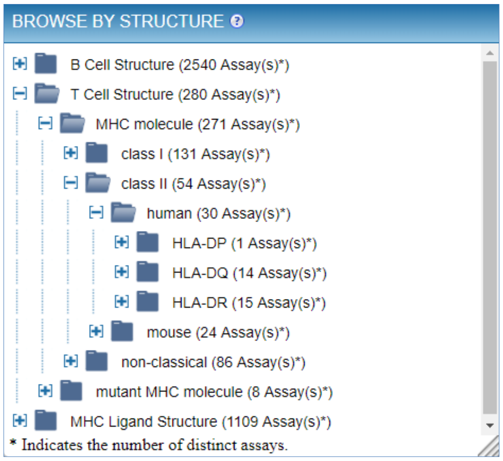


Figure 2.11 Identifier Search input screen

The Identifier Search input screen is shown in Figure 2.11. If users know the epitope, reference, submission, or assay identifier they are seeking, they can enter that information into one of the four IEDB Identifiers fields.

The Browse by 3D Structure selection screen in shown in Figure 2.12. Users can select 3D structure of interest to them based on availble structures within the database.



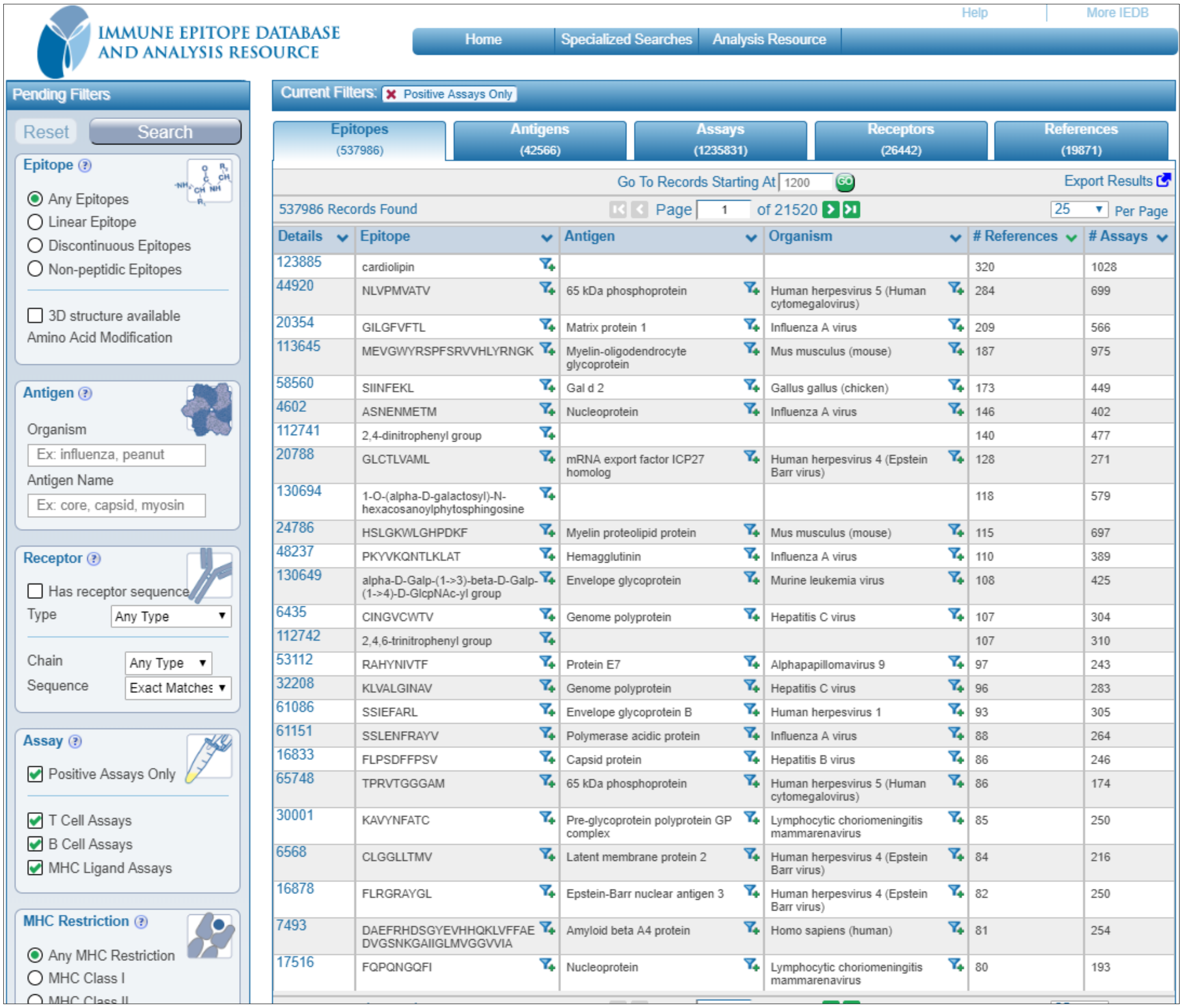
- B Cell Structure (2540 Assay(s)*)
- T Cell Structure (280 Assay(s)*)
  - MHC molecule (271 Assay(s)*)
    - class I (131 Assay(s)*)
    - class II (54 Assay(s)*)
      - human (30 Assay(s)*)
        - HLA-DP (1 Assay(s)*)
        - HLA-DQ (14 Assay(s)*)
        - HLA-DR (15 Assay(s)*)
      - mouse (24 Assay(s)*)
    - non-classical (86 Assay(s)*)
  - mutant MHC molecule (8 Assay(s)*)
- MHC Ligand Structure (1109 Assay(s)*)

* Indicates the number of distinct assays.

Figure 2.12 Browse by 3D Structure search

2.2.3 Search Results Page

The results of a search or query appear on the Results page. An example is shown in Figure 2.12. The search criteria are listed in the Current Filters section above the results table. There are five tabs for the results. Figure 2.12 displays the Epitopes tab. Results are initially sorted by the number of assays, but the user can click on the column header to change the sort order. A second click will reverse the sort order of the selected column. The table includes the epitope structure description, the corresponding antigen, source organism, the number of references in which the epitope appears, and the number of assays (positive and negative) that reside in the database. Clicking on the Epitope ID number in the far left column will take the user to a Distinct Epitope Detail page, as seen in Figure 2.13. The bottom section of the figure contains links to relevant tools in the Analysis Resource. Links can also appear to the Bioinformatics Resource Centers (BRC), such as the Influenza Research Database (IRD). The user can also refine the search results by clicking on the filter icon in the epitope, antigen, and organism fields.



Current Filters: ✖ Positive Assays Only

● Any Epitopes
○ Linear Epitope
○ Discontinuous Epitopes
○ Non-peptidic Epitopes
☐ 3D structure available
Amino Acid Modification

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

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

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

● Any MHC Restriction
○ MHC Class I
○ MHC Class II

Go To Records Starting At 1200

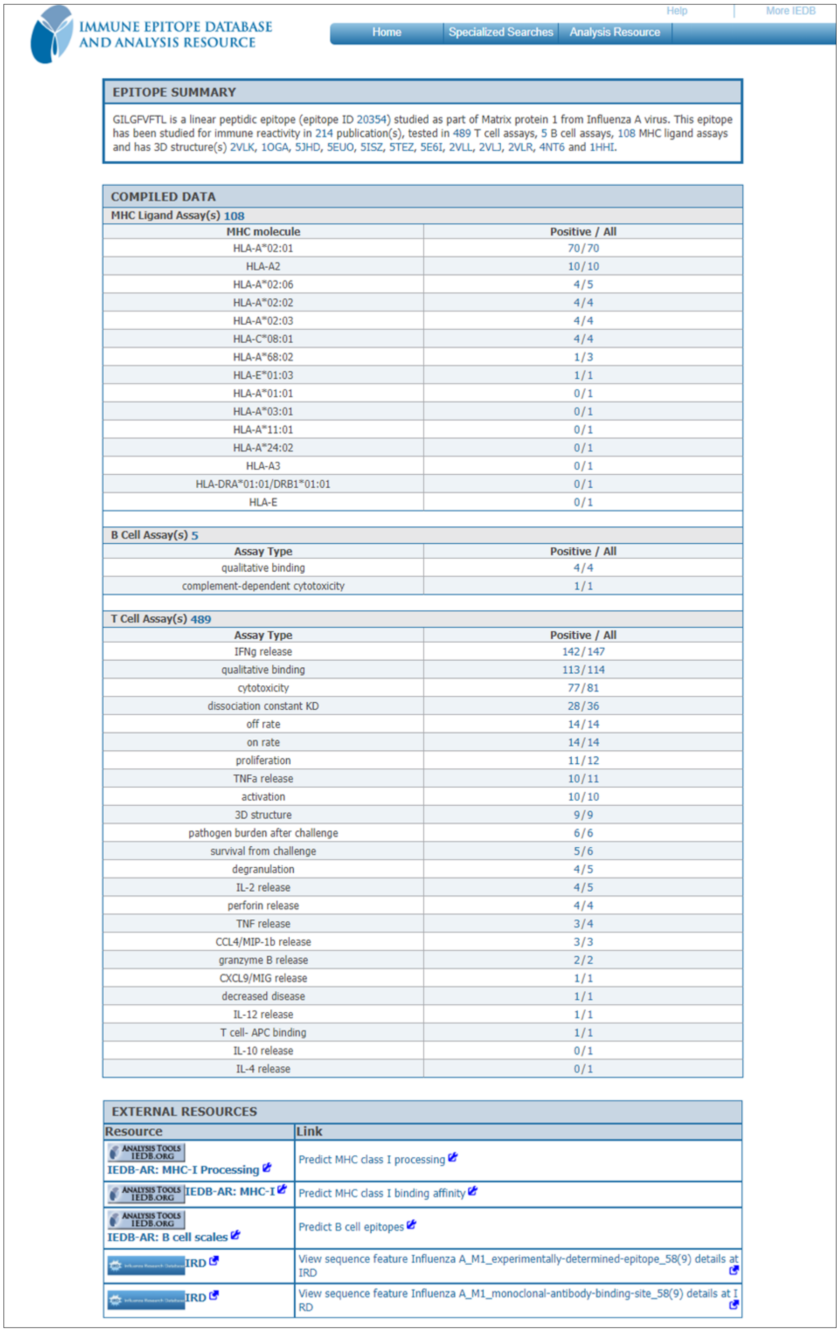
537986 Records Found

Page 1 of 21520

25 Per Page

Details	Epitope	Antigen	Organism	# References	# Assays
123885	cardiolipin			320	1028
44920	NLVPMVATV	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)	284	699
20354	GILGFVFTL	Matrix protein 1	Influenza A virus	209	566
113645	MEVGWYRSPFSRVVHLYRNGK	Myelin-oligodendrocyte glycoprotein	Mus musculus (mouse)	187	975
58560	SIINFEKL	Gal d 2	Gallus gallus (chicken)	173	449
4602	ASNENMETM	Nucleoprotein	Influenza A virus	146	402
112741	2,4-dinitrophenyl group			140	477
20788	GLCTLVAML	mRNA export factor ICP27 homolog	Human herpesvirus 4 (Epstein Barr virus)	128	271
130694	1-O-(alpha-D-galactosyl)-N-hexacosanoylphytosphingosine			118	579
24786	HSLGKWLGHPDKF	Myelin proteolipid protein	Mus musculus (mouse)	115	697
48237	PKYVKQNTLKLAT	Hemagglutinin	Influenza A virus	110	389
130649	alpha-D-Galp-(1->3)-beta-D-Galp-(1->4)-D-GlcpNAc-yl group	Envelope glycoprotein	Murine leukemia virus	108	425
6435	CINGVCWTV	Genome polyprotein	Hepatitis C virus	107	304
112742	2,4,6-trinitrophenyl group			107	310
53112	RAHYNIVTF	Protein E7	Alphapapillomavirus 9	97	243
32208	KLVALGINAV	Genome polyprotein	Hepatitis C virus	96	283
61086	SSIEFARL	Envelope glycoprotein B	Human herpesvirus 1	93	305
61151	SSLENFRAYV	Polymerase acidic protein	Influenza A virus	88	264
16833	FLPSDFFPSV	Capsid protein	Hepatitis B virus	86	246
65748	TPRVTGGGAM	65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)	86	174
30001	KAVYNFATC	Pre-glycoprotein polyprotein GP complex	Lymphocytic choriomeningitis mammarenavirus	85	250
6568	CLGGLLTMV	Latent membrane protein 2	Human herpesvirus 4 (Epstein Barr virus)	84	216
16878	FLRGRAYGL	Epstein-Barr nuclear antigen 3	Human herpesvirus 4 (Epstein Barr virus)	82	250
7493	DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA	Amyloid beta A4 protein	Homo sapiens (human)	81	254
17516	FQPQNGQFI	Nucleoprotein	Lymphocytic choriomeningitis mammarenavirus	80	193

Figure 2.13 The Epitope tab of the search results page



EPITOPE SUMMARY

GILGFVFTL is a linear peptidic epitope (epitope ID 20354) studied as part of Matrix protein 1 from Influenza A virus. This epitope has been studied for immune reactivity in 214 publication(s), tested in 489 T cell assays, 5 B cell assays, 108 MHC ligand assays and has 3D structure(s) 2VLK, 1OGA, 5JHD, 5EUO, 5ISZ, 5TEZ, 5E6I, 2VLL, 2VLJ, 2VLR, 4NT6 and 1HHI.

COMPILED DATA

MHC Ligand Assay(s) 108

MHC molecule	Positive / All
HLA-A*02:01	70 / 70
HLA-A2	10 / 10
HLA-A*02:06	4 / 5
HLA-A*02:02	4 / 4
HLA-A*02:03	4 / 4
HLA-C*08:01	4 / 4
HLA-A*68:02	1 / 3
HLA-E*01:03	1 / 1
HLA-A*01:01	0 / 1
HLA-A*03:01	0 / 1
HLA-A*11:01	0 / 1
HLA-A*24:02	0 / 1
HLA-A3	0 / 1
HLA-DRA*01:01/DRB1*01:01	0 / 1
HLA-E	0 / 1

B Cell Assay(s) 5

Assay Type	Positive / All
qualitative binding	4 / 4
complement-dependent cytotoxicity	1 / 1

T Cell Assay(s) 489

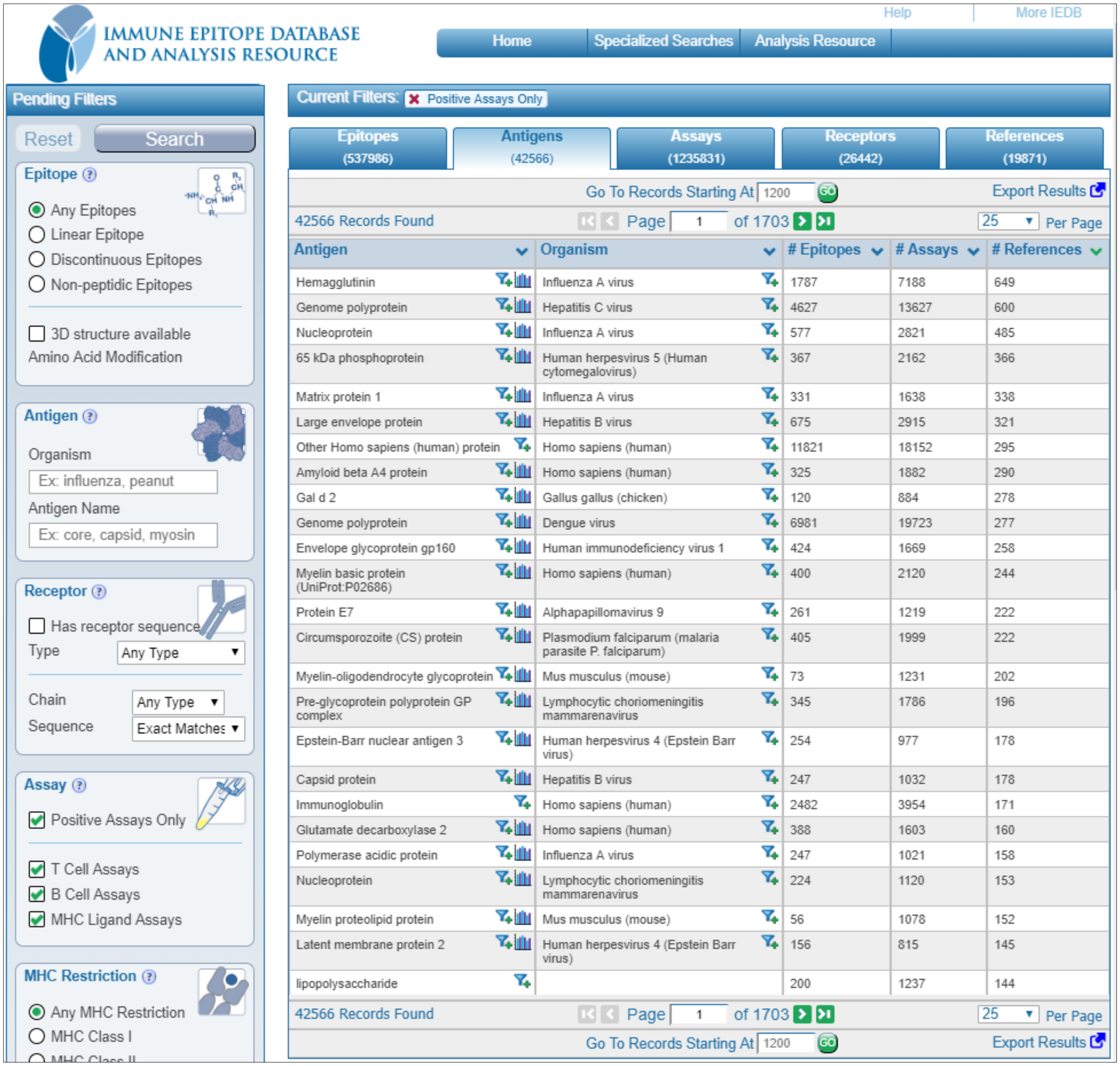
Assay Type	Positive / All
IFNg release	142 / 147
qualitative binding	113 / 114
cytotoxicity	77 / 81
dissociation constant KD	28 / 36
off rate	14 / 14
on rate	14 / 14
proliferation	11 / 12
TNFa release	10 / 11
activation	10 / 10
3D structure	9 / 9
pathogen burden after challenge	6 / 6
survival from challenge	5 / 6
degranulation	4 / 5
IL-2 release	4 / 5
perforin release	4 / 4
TNF release	3 / 4
CCL4/MIP-1b release	3 / 3
granzyme B release	2 / 2
CXCL9/MIG release	1 / 1
decreased disease	1 / 1
IL-12 release	1 / 1
T cell- APC binding	1 / 1
IL-10 release	0 / 1
IL-4 release	0 / 1

EXTERNAL RESOURCES

Resource	Link
ANALYSIS TOOLS IEDB.ORG IEDB-AR: MHC-I Processing	Predict MHC class I processing
ANALYSIS TOOLS IEDB.ORG IEDB-AR: MHC-I	Predict MHC class I binding affinity
ANALYSIS TOOLS IEDB.ORG IEDB-AR: B cell scales	Predict B cell epitopes
IRD	View sequence feature Influenza A_M1_experimentally-determined-epitope_58(9) details at IRD
IRD	View sequence feature Influenza A_M1_monoclonal-antibody-binding-site_58(9) details at IRD

Figure 2.14 An example of the epitope detail page

The second tab on the results page is the Antigens tab (Figure 2.14). Results are initially sorted by the number of assays, but the user can click on the column header to change the sort order. The table includes the antigen name, the corresponding source organism, the number of associated antigen epitopes in the IEDB, and the number of assays (positive and negative) that reside in the database. The user can explore the data related to a particular antigen by clicking on the funnel icon in the righthand side of the Antigen column. The data in the other three tabs will change accordingly as seen in Figure 2.15.



Pending Filters

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

MHC Restriction

● Any MHC Restriction
○ MHC Class I
○ MHC Class II

Current Filters: ☒ Positive Assays Only

Go To Records Starting At 1200

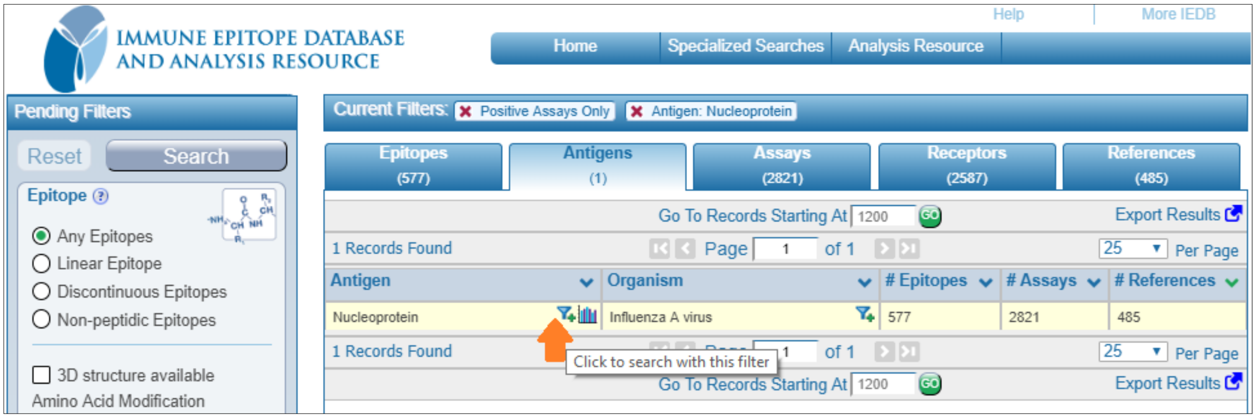
42566 Records Found — Page 1 of 1703 — 25 Per Page

Antigen	Organism	# Epitopes	# Assays	# References
Hemagglutinin	Influenza A virus	1787	7188	649
Genome polyprotein	Hepatitis C virus	4627	13627	600
Nucleoprotein	Influenza A virus	577	2821	485
65 kDa phosphoprotein	Human herpesvirus 5 (Human cytomegalovirus)	367	2162	366
Matrix protein 1	Influenza A virus	331	1638	338
Large envelope protein	Hepatitis B virus	675	2915	321
Other Homo sapiens (human) protein	Homo sapiens (human)	11821	18152	295
Amyloid beta A4 protein	Homo sapiens (human)	325	1882	290
Gal d 2	Gallus gallus (chicken)	120	884	278
Genome polyprotein	Dengue virus	6981	19723	277
Envelope glycoprotein gp160	Human immunodeficiency virus 1	424	1669	258
Myelin basic protein (UniProt:P02686)	Homo sapiens (human)	400	2120	244
Protein E7	Alphapapillomavirus 9	261	1219	222
Circumsporozoite (CS) protein	Plasmodium falciparum (malaria parasite P. falciparum)	405	1999	222
Myelin-oligodendrocyte glycoprotein	Mus musculus (mouse)	73	1231	202
Pre-glycoprotein polyprotein GP complex	Lymphocytic choriomeningitis mammarenavirus	345	1786	196
Epstein-Barr nuclear antigen 3	Human herpesvirus 4 (Epstein Barr virus)	254	977	178
Capsid protein	Hepatitis B virus	247	1032	178
Immunoglobulin	Homo sapiens (human)	2482	3954	171
Glutamate decarboxylase 2	Homo sapiens (human)	388	1603	160
Polymerase acidic protein	Influenza A virus	247	1021	158
Nucleoprotein	Lymphocytic choriomeningitis mammarenavirus	224	1120	153
Myelin proteolipid protein	Mus musculus (mouse)	56	1078	152
Latent membrane protein 2	Human herpesvirus 4 (Epstein Barr virus)	156	815	145
lipopolysaccharide		200	1237	144

42566 Records Found — Page 1 of 1703 — 25 Per Page

Go To Records Starting At 1200

Figure 2.15 The Antigens tab of the search results page



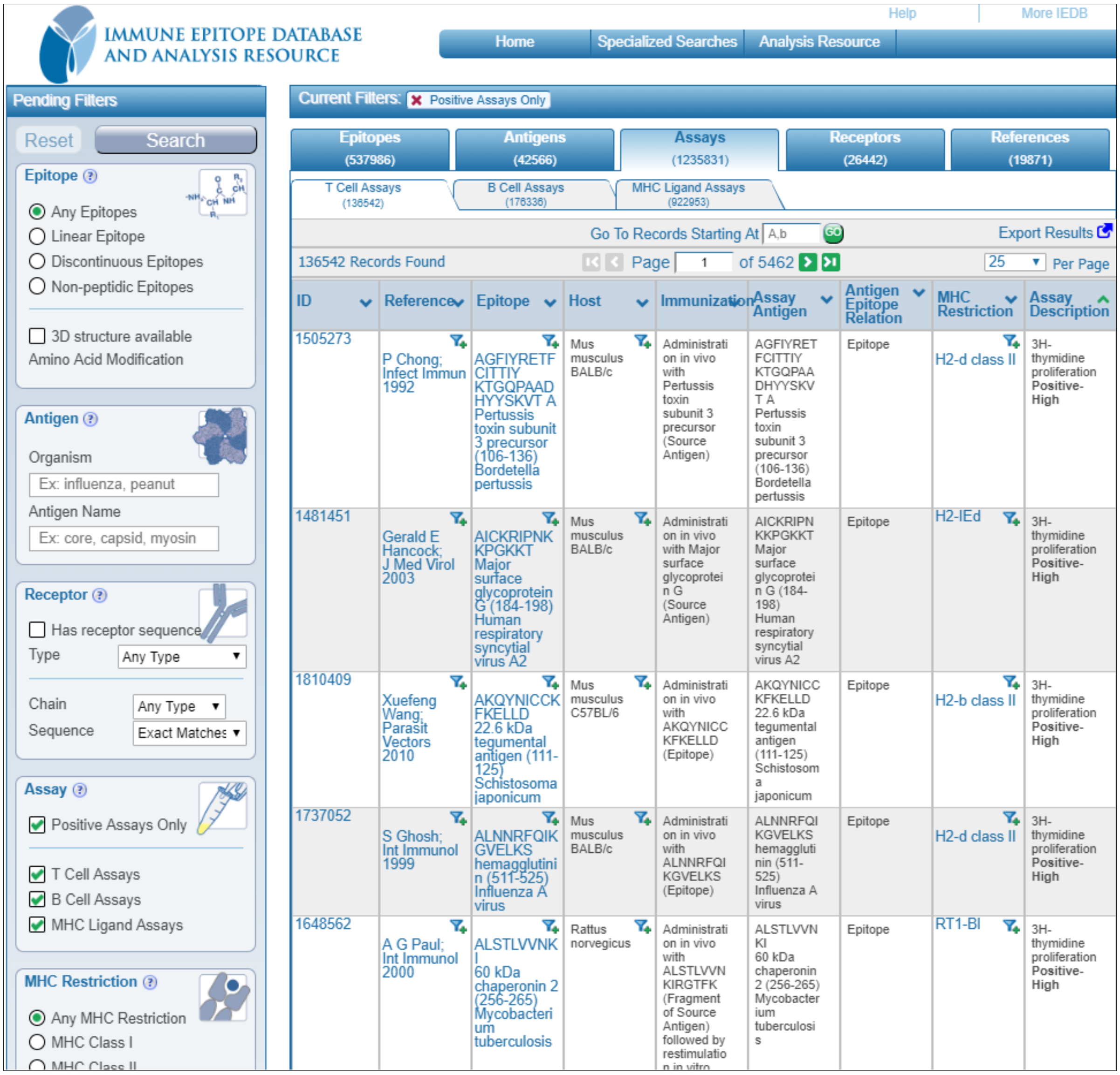
Current Filters: ✖ Positive Assays Only ✖ Antigen: Nucleoprotein

1 Records Found

Antigen	Organism	# Epitopes	# Assays	# References
Nucleoprotein	Influenza A virus	577	2821	485

Figure 2.16 The Results filtered by the Nucleoprotein of the Influenza A virus. This was achieved by clicking on the filter icon in the antigen column. The content of the other tabs contain data specific to this antigen.

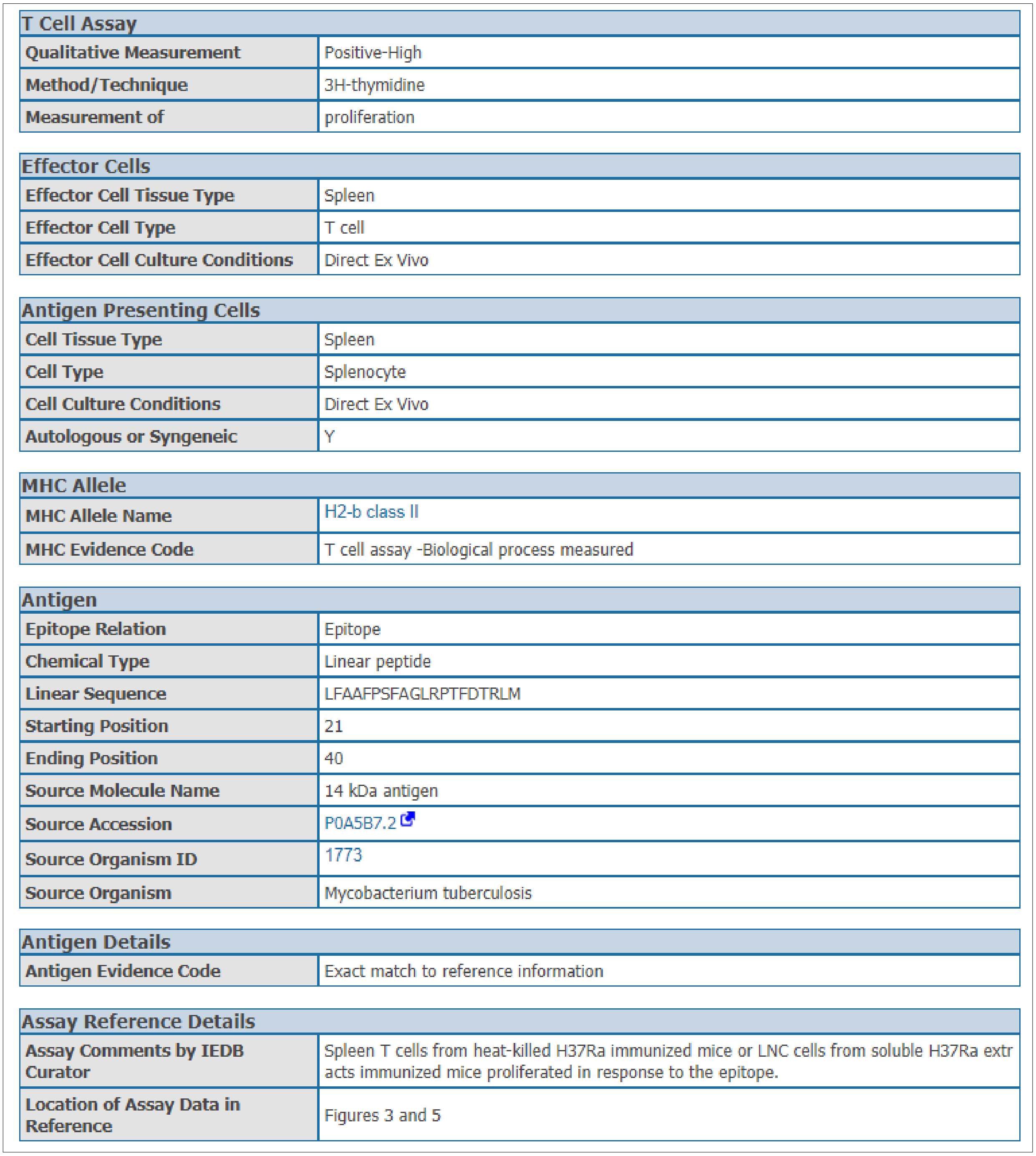
The third tab on the results page is the Assays tab (Figure 2.16). Results are initially sorted by the Assay Description, but the user can click on the column header to change the sort order. The table contains three additional tabs, one each for the three assay categories – T cell, B cell, and MHC Ligand. The table for the T cell assays includes the assay ID, the reference, epitope, host organism, immunization, assay antigen, antigen epitope relation, MHC restriction, and assay description. The content of the B cell assay tab is the same except it omits the MHC restriction column. The MHC ligand assay tab contains fields for assay ID, reference, epitope, antigen processing, MHC restriction, assay description, and quantitative measure. Clicking on the Assay ID in the far left lane will take the user to an Assay Detail page. An example is given in Figure 2.17. The actual page contains additional fields below what is shown in the figure, including sections for Epitope Reference Details, Immunization, Host Details, 1st In Vivo Process, Administation Details, 1st Immunogen, Immunogen Details, Immunization Comments, T Cell Assay, Effector Cells, Antigen Presenting Cells, MHC Allele, Antigen, Antigen Details, and Assay Reference Details. The user can also refine the results further by clicking on the filter icon that is available in seveal of the fields, such as reference, epitope, and host.



136542 Records Found

ID	Reference	Epitope	Host	Immunization	Assay Antigen	Antigen Epitope Relation	MHC Restriction	Assay Description
1505273	P Chong; Infect Immun 1992	AGFIYRETFCITTIYKTGQPAADHYYSKVT A Pertussis toxin subunit 3 precursor (106-136) Bordetella pertussis	Mus musculus BALB/c	Administration in vivo with Pertussis toxin subunit 3 precursor (Source Antigen)	AGFIYRETFCITTIYKTGQPAADHYYSKVT A Pertussis toxin subunit 3 precursor (106-136) Bordetella pertussis	Epitope	H2-d class II	3H-thymidine proliferation **Positive-High**
1481451	Gerald E Hancock; J Med Virol 2003	AICKRIPNKKPGKKT Major surface glycoprotein G (184-198) Human respiratory syncytial virus A2	Mus musculus BALB/c	Administration in vivo with Major surface glycoprotein G (Source Antigen)	AICKRIPNKKPGKKT Major surface glycoprotein G (184-198) Human respiratory syncytial virus A2	Epitope	H2-IEd	3H-thymidine proliferation **Positive-High**
1810409	Xuefeng Wang; Parasit Vectors 2010	AKQYNICCKFKELLD 22.6 kDa tegumental antigen (111-125) Schistosoma japonicum	Mus musculus C57BL/6	Administration in vivo with AKQYNICCKFKELLD (Epitope)	AKQYNICCKFKELLD 22.6 kDa tegumental antigen (111-125) Schistosoma japonicum	Epitope	H2-b class II	3H-thymidine proliferation **Positive-High**
1737052	S Ghosh; Int Immunol 1999	ALNNRFQIKGVELKS hemagglutinin (511-525) Influenza A virus	Mus musculus BALB/c	Administration in vivo with ALNNRFQIKGVELKS (Epitope)	ALNNRFQIKGVELKS hemagglutinin (511-525) Influenza A virus	Epitope	H2-d class II	3H-thymidine proliferation **Positive-High**
1648562	A G Paul; Int Immunol 2000	ALSTLVVNKI 60 kDa chaperonin 2 (256-265) Mycobacterium tuberculosis	Rattus norvegicus	Administration in vivo with ALSTLVVNKIRGTFK (Fragment of Source Antigen) followed by restimulation in vitro	ALSTLVVNKI 60 kDa chaperonin 2 (256-265) Mycobacterium tuberculosis	Epitope	RT1-Bl	3H-thymidine proliferation **Positive-High**

Figure 2.17 The Assays tab of the search results page. The page contains three additional tabs for T Cell, B Cell, and MHC Ligand Assays



T Cell Assay

Qualitative Measurement	Positive-High
Method/Technique	3H-thymidine
Measurement of	proliferation

Effector Cells

Effector Cell Tissue Type	Spleen
Effector Cell Type	T cell
Effector Cell Culture Conditions	Direct Ex Vivo

Antigen Presenting Cells

Cell Tissue Type	Spleen
Cell Type	Splenocyte
Cell Culture Conditions	Direct Ex Vivo
Autologous or Syngeneic	Y

MHC Allele

MHC Allele Name	H2-b class II
MHC Evidence Code	T cell assay -Biological process measured

Antigen

Epitope Relation	Epitope
Chemical Type	Linear peptide
Linear Sequence	LFAAFPSFAGLRPTFDTRLM
Starting Position	21
Ending Position	40
Source Molecule Name	14 kDa antigen
Source Accession	P0A5B7.2
Source Organism ID	1773
Source Organism	Mycobacterium tuberculosis

Antigen Details

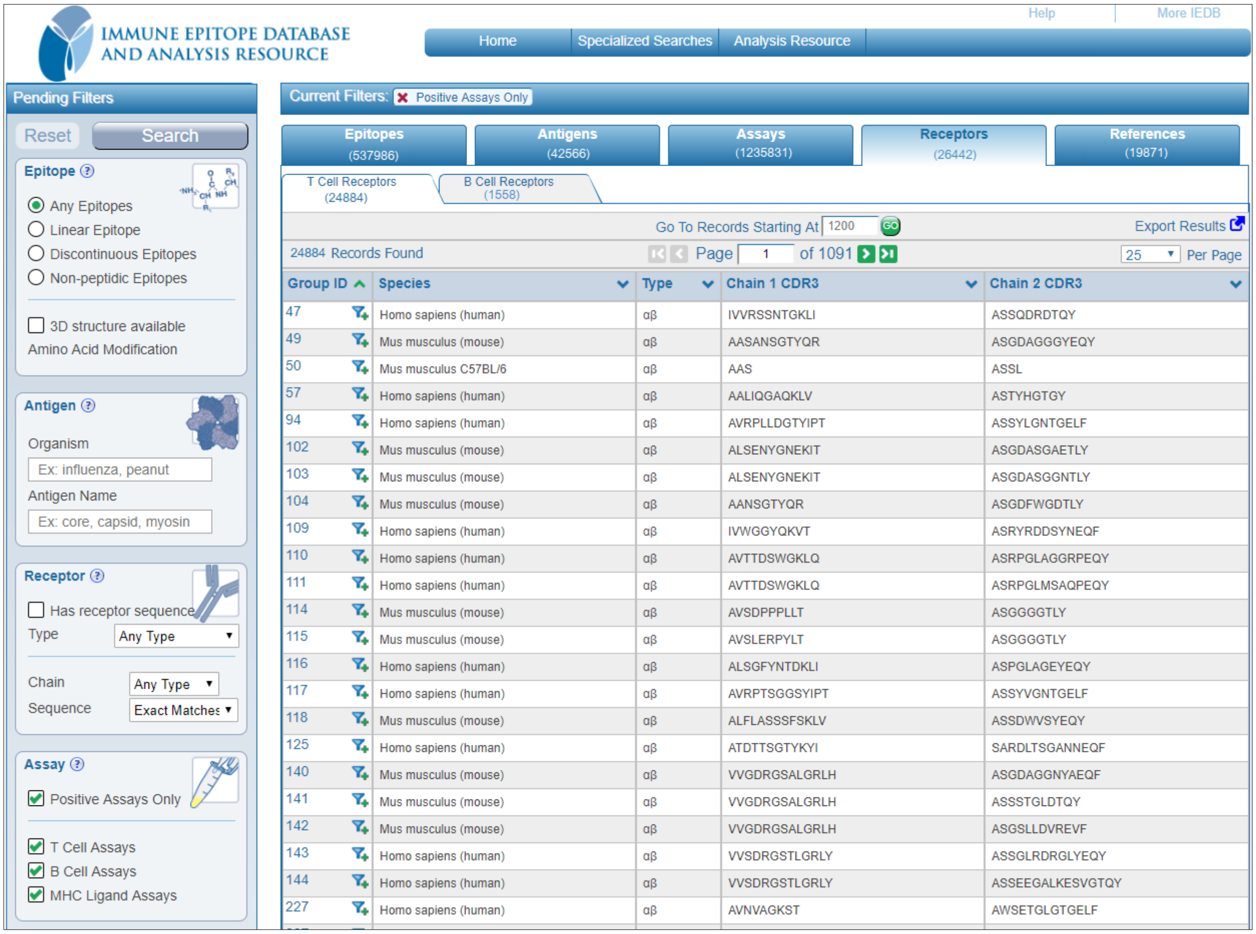
Antigen Evidence Code	Exact match to reference information

Assay Reference Details

Assay Comments by IEDB Curator	Spleen T cells from heat-killed H37Ra immunized mice or LNC cells from soluble H37Ra extracts immunized mice proliferated in response to the epitope.
Location of Assay Data in Reference	Figures 3 and 5

Figure 2.18 The top three sections of a sample T cell assay detail page.

The fourth tab on the results page is the Receptors tab (Figure 2.19). The Receptors tab indicates the distinct receptor group, the species, and the receptor types alongside the sequences of each chain component. The display is subdivided into two separate tabs for TCRs and BCRs. Clicking on the Group ID links brings the user to a receptor specific details page.



Current Filters: ✖ Positive Assays Only

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

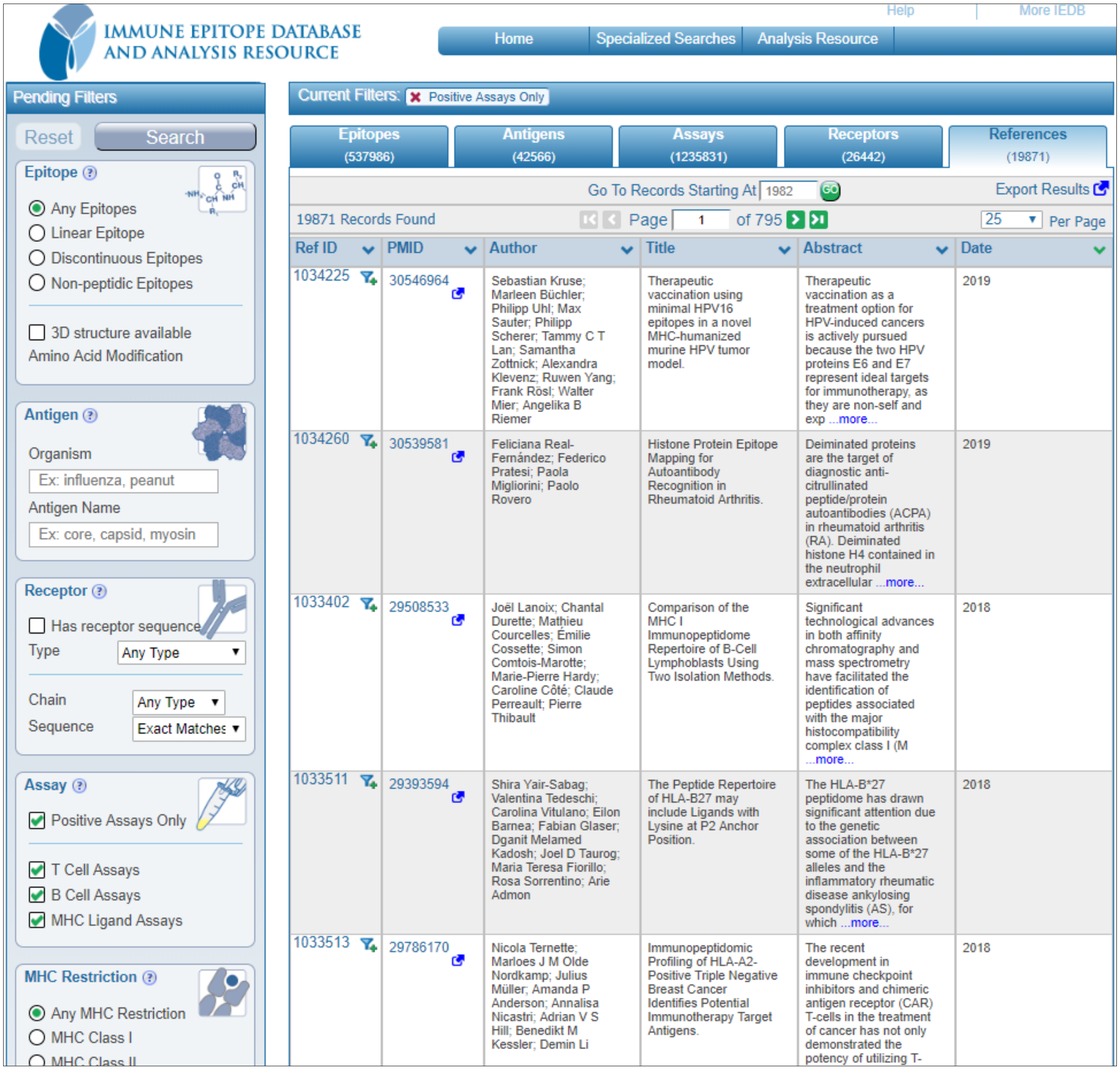
Go To Records Starting At 1200 GO

24884 Records Found — Page 1 of 1091 — 25 Per Page

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

Figure 2.19 The Receptors tab of the search results page

The fifth tab on the results page is the References tab (Figure 2.20). Results are initially sorted by the year of publication or submission, the most recent references first. Again, the user can click on the column header to change the sort order. The table includes the IEDB-assigned reference ID, the PubMed ID, authors, article title, abstract, and the date. For journal articles, the information is downloaded directly from PubMed. Clicking on the Ref ID in the far left lane will take the user to a Reference Detail page. An example is given in Figure 2.19.



Current Filters: ☒ Positive Assays Only

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

MHC Restriction
● Any MHC Restriction
○ MHC Class I
○ MHC Class II

Go To Records Starting At: 1982

19871 Records Found
Page 1 of 795
25 Per Page

Ref ID	PMID	Author	Title	Abstract	Date
1034225	30546964	Sebastian Kruse; Marleen Büchler; Philipp Uhl; Max Sauter; Philipp Scherer; Tammy C T Lan; Samantha Zottnick; Alexandra Klevenz; Ruwen Yang; Frank Rösl; Walter Mier; Angelika B Riemer	Therapeutic vaccination using minimal HPV16 epitopes in a novel MHC-humanized murine HPV tumor model.	Therapeutic vaccination as a treatment option for HPV-induced cancers is actively pursued because the two HPV proteins E6 and E7 represent ideal targets for immunotherapy, as they are non-self and exp ...more...	2019
1034260	30539581	Feliciana Real-Fernández; Federico Pratesi; Paola Migliorini; Paolo Rovero	Histone Protein Epitope Mapping for Autoantibody Recognition in Rheumatoid Arthritis.	Deiminated proteins are the target of diagnostic anti-citrullinated peptide/protein autoantibodies (ACPA) in rheumatoid arthritis (RA). Deiminated histone H4 contained in the neutrophil extracellular ...more...	2019
1033402	29508533	Joël Lanoix; Chantal Durette; Mathieu Courcelles; Émilie Cossette; Simon Comtois-Marotte; Marie-Pierre Hardy; Caroline Côté; Claude Perreault; Pierre Thibault	Comparison of the MHC I Immunopeptidome Repertoire of B-Cell Lymphoblasts Using Two Isolation Methods.	Significant technological advances in both affinity chromatography and mass spectrometry have facilitated the identification of peptides associated with the major histocompatibility complex class I (M ...more...	2018
1033511	29393594	Shira Yair-Sabag; Valentina Tedeschi; Carolina Vitulano; Eilon Barnea; Fabian Glaser; Dganit Melamed Kadosh; Joel D Taurog; Maria Teresa Fiorillo; Rosa Sorrentino; Arie Admon	The Peptide Repertoire of HLA-B27 may include Ligands with Lysine at P2 Anchor Position.	The HLA-B*27 peptidome has drawn significant attention due to the genetic association between some of the HLA-B*27 alleles and the inflammatory rheumatic disease ankylosing spondylitis (AS), for which ...more...	2018
1033513	29786170	Nicola Ternette; Marloes J M Olde Nordkamp; Julius Müller; Amanda P Anderson; Annalisa Nicastri; Adrian V S Hill; Benedikt M Kessler; Demin Li	Immunopeptidomic Profiling of HLA-A2-Positive Triple Negative Breast Cancer Identifies Potential Immunotherapy Target Antigens.	The recent development in immune checkpoint inhibitors and chimeric antigen receptor (CAR) T-cells in the treatment of cancer has not only demonstrated the potency of utilizing T-	2018

Figure 2.20 The References tab of the search results page

Reference	
Article Authors	Shira Yair-Sabag; Valentina Tedeschi; Carolina Vitulano; Eilon Barnea; Fabian Glaser; Dganit Melamed Kadosh; Joel D Taurog; Maria Teresa Fiorillo; Rosa Sorrentino; Arie Admon
Article Title	The Peptide Repertoire of HLA-B27 may include Ligands with Lysine at P2 Anchor Position.

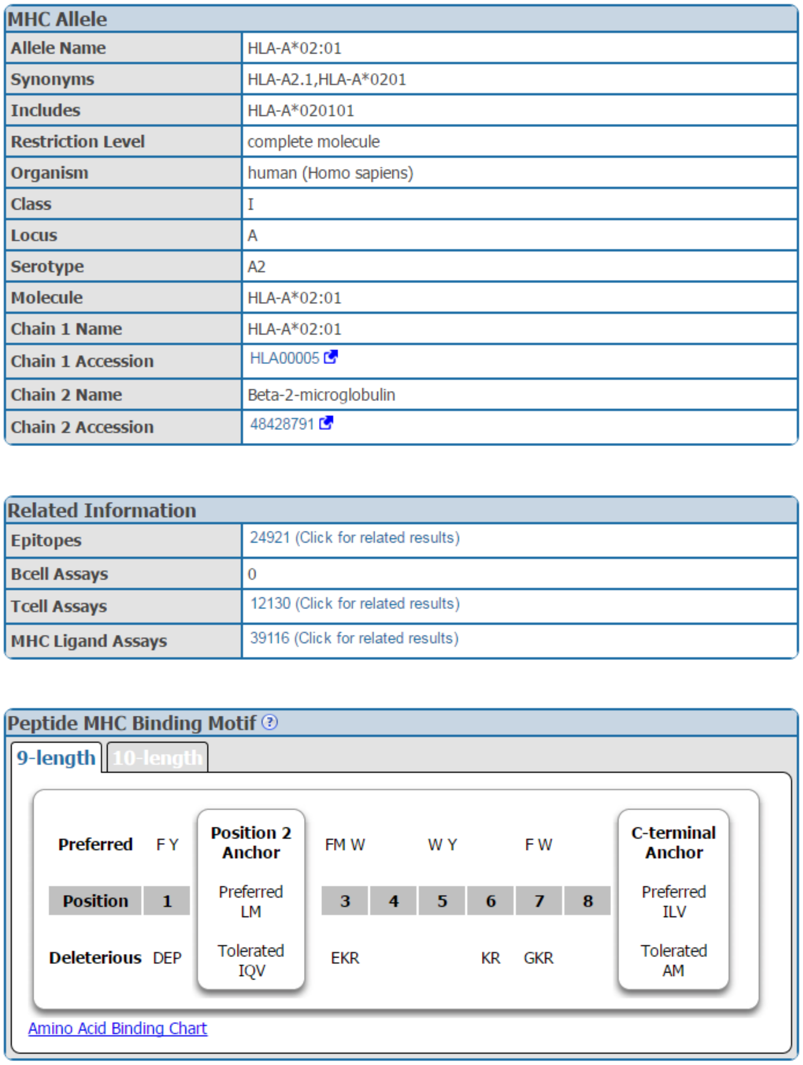
Reference Detail	
Reference ID	1033511
Abstract	The HLA-B*27 peptidome has drawn significant attention due to the genetic association between some of the HLA-B*27 alleles and the inflammatory rheumatic disease ankylosing spondylitis (AS), for which a comprehensive biological explanation is still lacking. This study aims to expand the known limits of the HLA-B*27 peptidome to facilitate selection and testing of new peptides, possibly involved in the disease. The HLA peptidomes of HeLa and C1R cell lines stably transfected with the AS-associated HLA-B*27:05 allele, the nonassociated HLA-B*27:09 allele, or their cysteine 67 to serine mutants (C67S), are analyzed on a very large scale. In addition, the peptidomes of HLA-B*27:05 and HLA-B*27:05-C67S are analyzed from the spleens of rats transgenic for these alleles. The results indicate that C67S mutation increases the percentage of peptides with glutamine or lysine at their P2 position (P2-Lys), in both HLA-B*27:05 and HLA-B*27:09. Furthermore, a small fraction of HLA-B*27 peptides contains lysine at their second position (P2), in addition to the more commonly found peptides with arginine (P2-Arg) or the less common glutamine (P2-Gln) located at this anchor position. Overall these data indicate that peptides with P2-Lys should be considered as real ligands of HLA-B*27 molecules and taken into account while looking for putative peptides implicated in the AS.
Affiliations	Department of Biology, Technion-Israel Institute of Technology, Haifa, Israel; Department of Biology and Biotechnology "C. Darwin", Sapienza University of Rome, Rome, Italy; Bioinformatics Knowledge Unit, The Lorry I. Lokey Interdisciplinary Center for Life Sciences and Engineering, Technion-Israel Institute of Technology, Haifa, Israel; Department of Internal Medicine, University of Texas Southwestern Medical Center, Dallas, USA.
Date	2018
Reference Type	Literature
PubMed ID	29393594
Journal	Proteomics
Journal Volume	18
Article Pages	e1700249
Journal ISSN	1615-9861
Curation Last Updated	2019-01-03 23:39:42

Related Information	
Epitopes	34798 (Click for related results)
Bcell Assays	0
Tcell Assays	0
MHC Ligand Assays	42431 (Click for related results)

Figure 2.21 An example of the Reference detail page

2.2.3.1 Peptide MHC Binding Motif Displays

A display of peptide MHC binding motif diagrams and amino acid binding charts for a subset of MHC allele records appears on the MHC Allele Details page. Clicking on the allele name in the MHC Restriction column on the Assays tab for T Cells and MHC Ligand will bring the user to an MHC Allele Details page (Figure 2.22). As can be seen by the tabs in the binding motif display, the Peptide MHC Binding Motif diagrams on MHC Allele Information pages support diagrams for multiple lengths.



MHC Allele

Allele Name	HLA-A*02:01
Synonyms	HLA-A2.1,HLA-A*0201
Includes	HLA-A*020101
Restriction Level	complete molecule
Organism	human (Homo sapiens)
Class	I
Locus	A
Serotype	A2
Molecule	HLA-A*02:01
Chain 1 Name	HLA-A*02:01
Chain 1 Accession	HLA00005
Chain 2 Name	Beta-2-microglobulin
Chain 2 Accession	48428791

Related Information

Epitopes	24921 (Click for related results)
Bcell Assays	0
Tcell Assays	12130 (Click for related results)
MHC Ligand Assays	39116 (Click for related results)

Peptide MHC Binding Motif

Preferred	F Y	Position 2 Anchor Preferred LM Tolerated IQV	FM W		W Y		F W		C-terminal Anchor Preferred ILV Tolerated AM
Position	1		3	4	5	6	7	8	
Deleterious	DEP		EKR			KR	GKR		

Figure 2.22 Sample MHC Allele Details page with Peptide MHC Binding Motif diagram for HLA-A*02:01. Note the link to the corresponding Amino Acid Binding Chart on the bottom left of the diagram

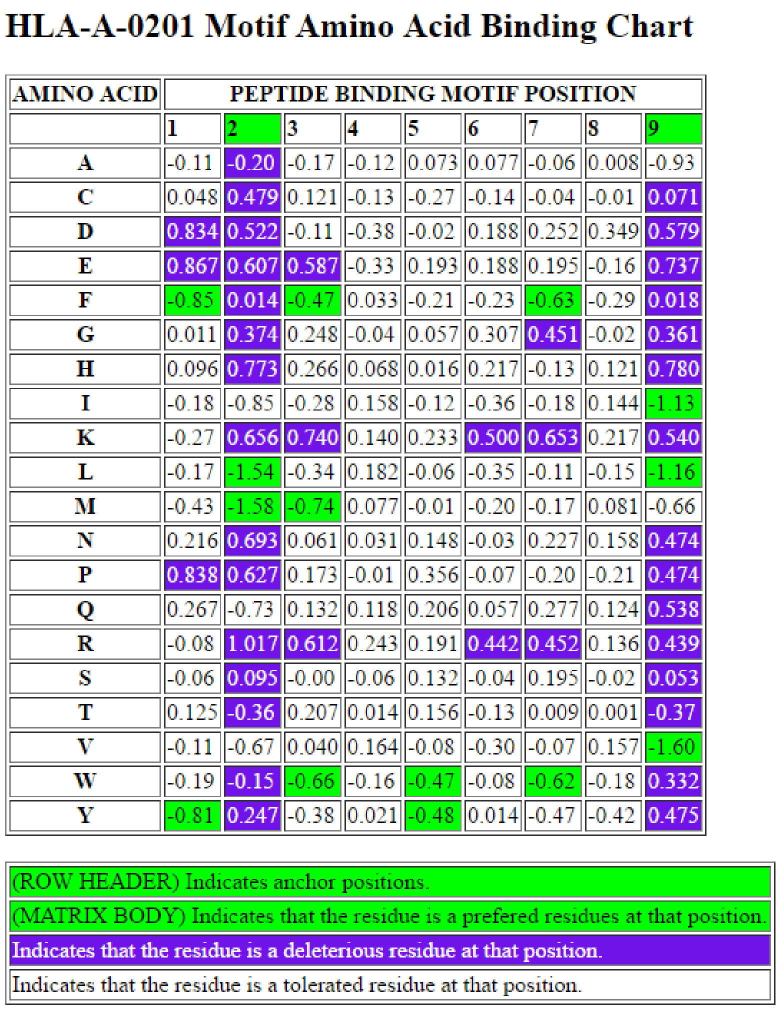
The Peptide MHC Binding Motif diagram summarizes the results of the amino acid binding for each position, which is shown in Figure 2.23. The amino acids are color-coded for each position, where green indicates the residue is preferred for binding, purple indicates it is deleterious for binding, and white indicates the residue is tolerated at that position. The motif diagram shows which residues are preferred and tolerated at the anchor positions, and which residues are preferred and deleterious at the non-anchor positions.

The residue preference is calculated from the SMM prediction matrix, which is described in Section 2.3.1.1. The following steps are taken in determining the residue preference at each position:

For anchor position:

1. determine the best value of this position from corresponding column of the SMM matrix
2. if a residue's value in this column of the SMM matrix is within 3 fold of the best value, designate this residue as prefered
3. if a residue's value in this column of the SMM matrix is within 10 fold of the best value, designate this residue as tolerated

4. The remaining residues are designated as deleterious



HLA-A-0201 Motif Amino Acid Binding Chart

AMINO ACID	PEPTIDE BINDING MOTIF POSITION								
	1	2	3	4	5	6	7	8	9
A	-0.11	-0.20	-0.17	-0.12	0.073	0.077	-0.06	0.008	-0.93
C	0.048	0.479	0.121	-0.13	-0.27	-0.14	-0.04	-0.01	0.071
D	0.834	0.522	-0.11	-0.38	-0.02	0.188	0.252	0.349	0.579
E	0.867	0.607	0.587	-0.33	0.193	0.188	0.195	-0.16	0.737
F	-0.85	0.014	-0.47	0.033	-0.21	-0.23	-0.63	-0.29	0.018
G	0.011	0.374	0.248	-0.04	0.057	0.307	0.451	-0.02	0.361
H	0.096	0.773	0.266	0.068	0.016	0.217	-0.13	0.121	0.780
I	-0.18	-0.85	-0.28	0.158	-0.12	-0.36	-0.18	0.144	-1.13
K	-0.27	0.656	0.740	0.140	0.233	0.500	0.653	0.217	0.540
L	-0.17	-1.54	-0.34	0.182	-0.06	-0.35	-0.11	-0.15	-1.16
M	-0.43	-1.58	-0.74	0.077	-0.01	-0.20	-0.17	0.081	-0.66
N	0.216	0.693	0.061	0.031	0.148	-0.03	0.227	0.158	0.474
P	0.838	0.627	0.173	-0.01	0.356	-0.07	-0.20	-0.21	0.474
Q	0.267	-0.73	0.132	0.118	0.206	0.057	0.277	0.124	0.538
R	-0.08	1.017	0.612	0.243	0.191	0.442	0.452	0.136	0.439
S	-0.06	0.095	-0.00	-0.06	0.132	-0.04	0.195	-0.02	0.053
T	0.125	-0.36	0.207	0.014	0.156	-0.13	0.009	0.001	-0.37
V	-0.11	-0.67	0.040	0.164	-0.08	-0.30	-0.07	0.157	-1.60
W	-0.19	-0.15	-0.66	-0.16	-0.47	-0.08	-0.62	-0.18	0.332
Y	-0.81	0.247	-0.38	0.021	-0.48	0.014	-0.47	-0.42	0.475

(ROW HEADER) Indicates anchor positions.

(MATRIX BODY) Indicates that the residue is a prefered residues at that position.

Indicates that the residue is a deleterious residue at that position.

Indicates that the residue is a tolerated residue at that position.

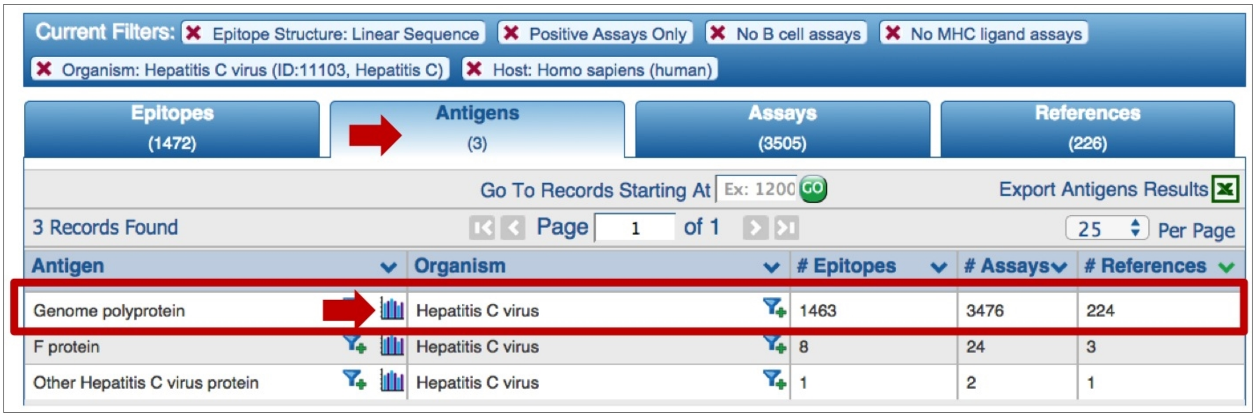
Figure 2.23 Amino acid binding matrix for MHC allele HLA-A*02:01

For non-anchor position:

1. determine the median value of this position from corresponding column of the SMM matrix
2. if a residue's value in this column of the SMM matrix is within 3 fold of the median value, designate this residue as tolerated
3. if a residue's value in this column of the SMM matrix is above 3 fold of the median value, designate this residue as prefered
4. if a residue's value in this column of the SMM matrix is below 3 fold of the median value, designate this residue as deleterious

2.2.3.2 Immunome Browser

The Immunome Browser is a feature integrated into the IEDB to more efficiently display large sets of immune epitope data. The purpose of the tool is to allow users to explore how often each protein region has been studied in immune assays and in how many assays the immune response was positive or negative. The Immunome Browser "maps" query results from the IEDB onto a reference proteome. A reference proteome is used because (1) epitopes reported in IEDB were identified for different strains and protein isoforms – mapping to the reference protein allows to visualize and study such epitopes as they would have the same antigen; (2) different mutant variants of the same epitope were tested and reported; and (3) immune response varies among studies and assays due to heterogeneity of samples and complexity of immune response. The Immunome Browser presents the mapped data along with calculated ‘epitope prominence scores’ that rank known epitopes based on how frequently subjects responded to each epitope, allowing identification of immunodominance. Both linear and discontinuous linear peptide epitopes with T cell or B cell responses are supported for viewing using the Immunome Browser. It is accessible via the Immunome Browser icon on the Antigen tab on the results page, as seen in Figure 2.24.



Current Filters: ✖ Epitope Structure: Linear Sequence ✖ Positive Assays Only ✖ No B cell assays ✖ No MHC ligand assays ✖ Organism: Hepatitis C virus (ID:11103, Hepatitis C) ✖ Host: Homo sapiens (human)

Epitopes (1472) | Antigens (3) | Assays (3505) | References (226)

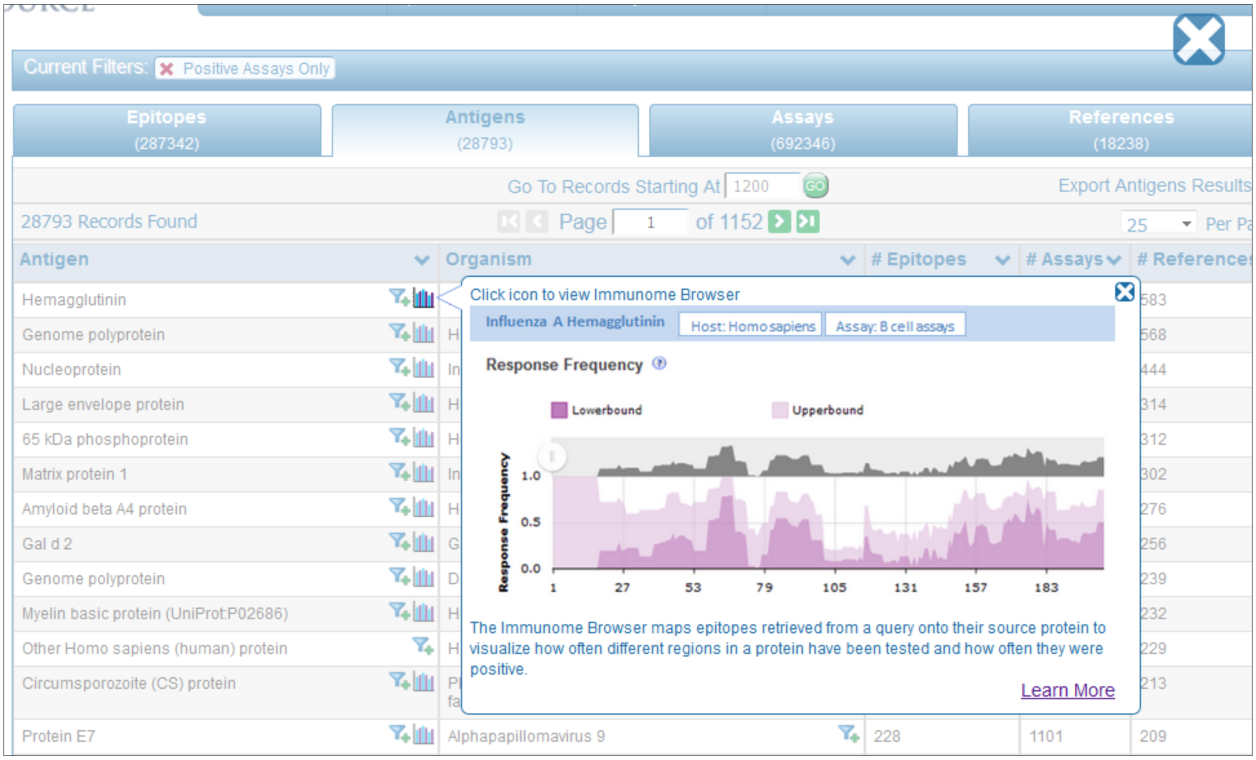
Go To Records Starting At Ex: 1200 GO   Export Antigens Results

3 Records Found   Page 1 of 1   25 Per Page

Antigen	Organism	# Epitopes	# Assays	# References
Genome polyprotein	Hepatitis C virus	1463	3476	224
F protein	Hepatitis C virus	8	24	3
Other Hepatitis C virus protein	Hepatitis C virus	1	2	1

Figure 2.24 The Immunome Browser is accessed by clicking on the icon shown on the Antigen tab on the results page of a query

In order to make the Immunome Browser capability more prominent, a pop-up window was added that appears the first time a user goes to the Antigen tab after making a search, as seen in Figure 2.25. It can be easily dismissed by clicking on the large X in the upper right-hand corner or clicking anywhere else on the window.



Antigen	Organism	# Epitopes	# Assays	# Reference
Hemagglutinin				583
Genome polyprotein	H			568
Nucleoprotein	In			444
Large envelope protein	H			314
65 kDa phosphoprotein	H			312
Matrix protein 1	In			302
Amyloid beta A4 protein	H			276
Gal d 2	G			256
Genome polyprotein	D			239
Myelin basic protein (UniProt:P02686)	H			232
Other Homo sapiens (human) protein	H			229
Circumsporozoite (CS) protein	Pl fa			213
Protein E7	Alphapapillomavirus 9	228	1101	209

Click icon to view Immunome Browser

The Immunome Browser maps epitopes retrieved from a query onto their source protein to visualize how often different regions in a protein have been tested and how often they were positive.

Learn More

Figure 2.25 A pop-up window appears each time the user clicks on the Antigen tab on the Results page. It highlights the Immunome Browser icon and briefly explains the Immunome Browser's functionality.

In the Immunome Browser, each selected antigen is considered to be a target protein, and the tool by default maps and visualizes all epitopes in the query result that are from the source antigen, which is the target protein or any of its taxonomic child. The mapping is done using the alignment between the source antigen and the target protein, and matching the epitope positions in the source antigen with the residue positions in the target protein. By default, epitopes that were tested as negative for the correspondent query will be mapped as well, even if the user queried only for positive assays. Also, the epitopes that failed to satisfy the default mapping criteria won't be mapped and visualized. The Immunome Browser output for query criteria of T cell assays, linear epitopes, Hepatitis C virus, and human host is shown in Figure 2.26.

Immunome Browser

Hepatitis C virus - Genome polyprotein

Pending Filters: Positive Assays Only | Epitope Structure: Linear Sequence | Organism: Hepatitis C virus (ID:11103, Hepatitis C) | No B cell assays | No MHC ligand assays | Host: Homo sapiens (human)

Lowerbound 0.11

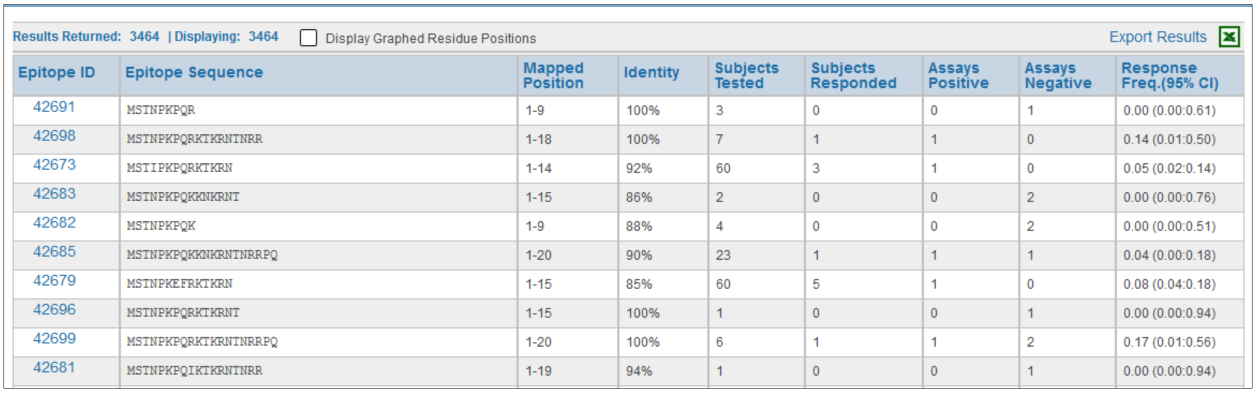
Upperbound 0.19

Controls

Residue Position Start 1 End 3011

Figure 2.26 Immunome Browser graphical output displaying assay results mapped onto a reference proteome by residue position

Two graphs are generated in the Immunome Browser. The upper plot titled "Response Frequency" renders the lower (dark color) and upper (light color) bounds of the 95% confidence interval (CI) of the response frequency (RF) for each position target protein position, averaged over all epitopes mapped to that position. RF is calculated as the number of positively responded subjects (or individuals in this case) relative to the total number of those tested summed up by mapped epitopes. The graph, however, displays only the upper and lower bounds of the 95% confidence interval (CI) for the RF score and not the RF score itself. The lower plot, titled "Epitope Assay Counts," indicates the number of positive and negative assays for each residue position.


Results Returned: 3464 | Displaying: 3464 ☐ 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)
42691	MSTNPKPQR	1-9	100%	3	0	0	1	0.00 (0.00:0.61)
42698	MSTNPKPQRKTKRNTNRR	1-18	100%	7	1	1	0	0.14 (0.01:0.50)
42673	MSTIPKPQRKTKRN	1-14	92%	60	3	1	0	0.05 (0.02:0.14)
42683	MSTNPKPQKKNKRNT	1-15	86%	2	0	0	2	0.00 (0.00:0.76)
42682	MSTNPKPQK	1-9	88%	4	0	0	2	0.00 (0.00:0.51)
42685	MSTNPKPQKKNKRNTNRRPQ	1-20	90%	23	1	1	1	0.04 (0.00:0.18)
42679	MSTNPKEFRKTKRN	1-15	85%	60	5	1	0	0.08 (0.04:0.18)
42696	MSTNPKPQRKTKRNT	1-15	100%	1	0	0	1	0.00 (0.00:0.94)
42699	MSTNPKPQRKTKRNTNRRPQ	1-20	100%	6	1	1	2	0.17 (0.01:0.56)
42681	MSTNPKPQIKTKRNTNRR	1-19	94%	1	0	0	1	0.00 (0.00:0.94)

Figure 2.27 Immunome Browser tabular output.

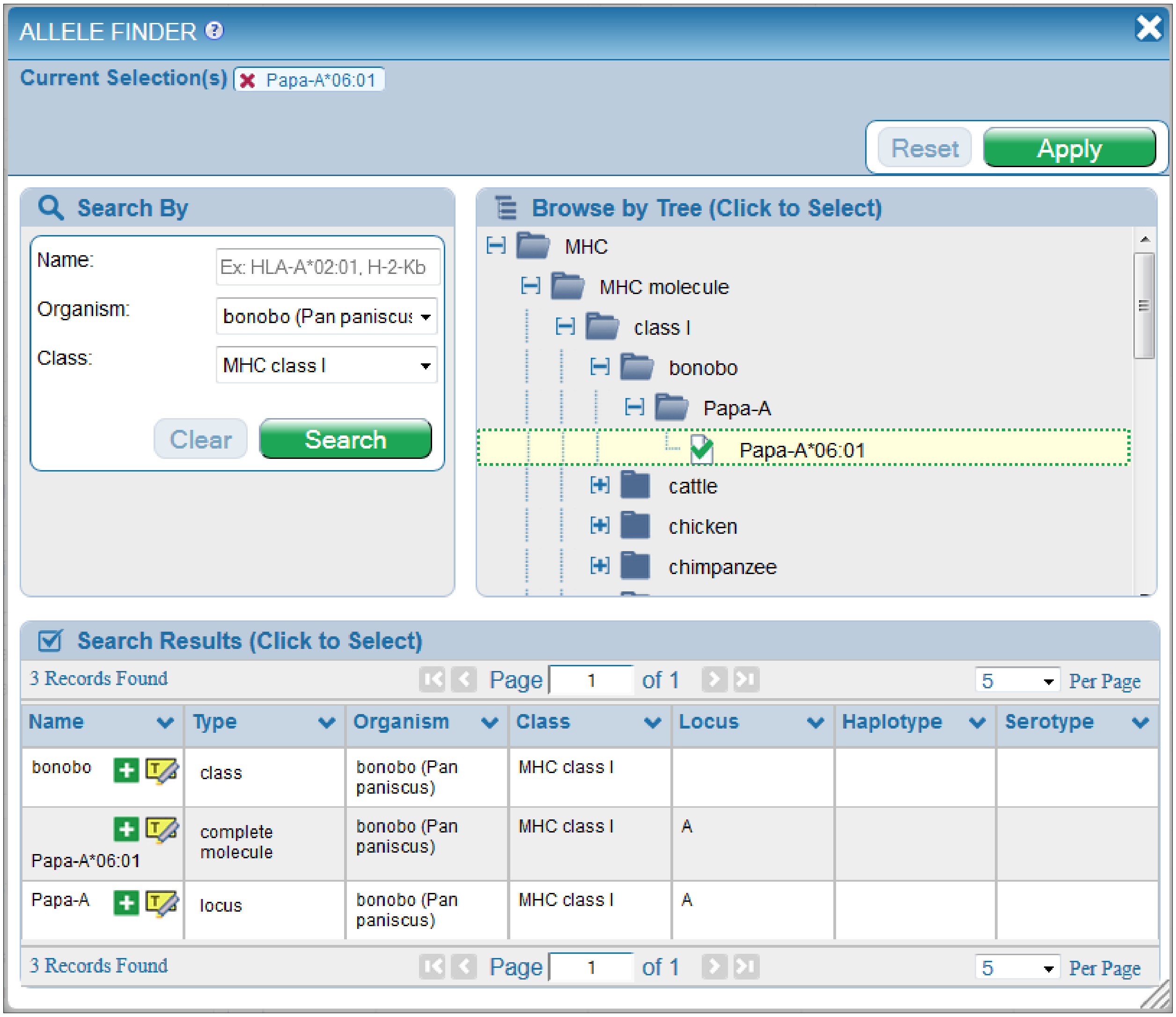
In addition to the plots, a table is generated that displays the epitope ID, sequence, position, and identity, as well as the number of subjects tested, the number who responded, and number of positive and negative assays, and the response frequency (Figure 2.27). The user can interactively zoom in and out onthe plots to a specific protein region and, if the check box for the table to correspond the plots is selected, the table is automatically updated to show only epitope from the selected region. Alternatively, the user can specify the residue start and end positions at the bottom of plots and click Update Display.

2.2.4 Finders Overview

Several finders (Allele, Assay, Disease, Molecule, Geolocation, and Organism) are available to help facilitate selections and control vocabulary usage, thus improving query results. At times the potential list of selections can be quite extensive, and the finders help users make selections from large lists. The finders can be utilized when performing all queries. Multiple selections can be made when utilizing finders during a query.

2.2.4.1 Allele Finder

The MHC Allele Finder facilitates the selection of one or more MHC alleles. The finder consists of four sections as shown in Figure 2.28. The top section lists the alleles that the user selects. The selections can be removed by clicking on the red X of an allele name or by clicking on the Reset button to delete all selected alleles. When the user has completed the selection process, the user needs to click the green Apply button. The middle left section of the finder contains the “Search By” panel. Users can search by allele name, source organism, and/or class (I, II, or non-classical). After the user supplies their search criteria and clicks the Search button, the system will filter the list of MHC alleles using the organism, class, and allele provided. The allele finder uses wild card characters by default on both ends of criteria entered into the allele field. The system then returns in the bottom “Search Results” panel a list of any alleles that contain the value in the name field and match the class selected. Users can click on the green “+” icon to select an allele. Users can also click on the yellow highlighter icon to highlight the allele in the allele tree in the middle right section of the finder. Alternatively, a user can browse the hierarchical allele tree. Clicking on a node in this tree will add the allele to the Current Selections section of the finder.



Current Selection(s) Papa-A*06:01

Name: Ex: HLA-A*02:01, H-2-Kb
Organism: bonobo (Pan paniscus
Class: MHC class I

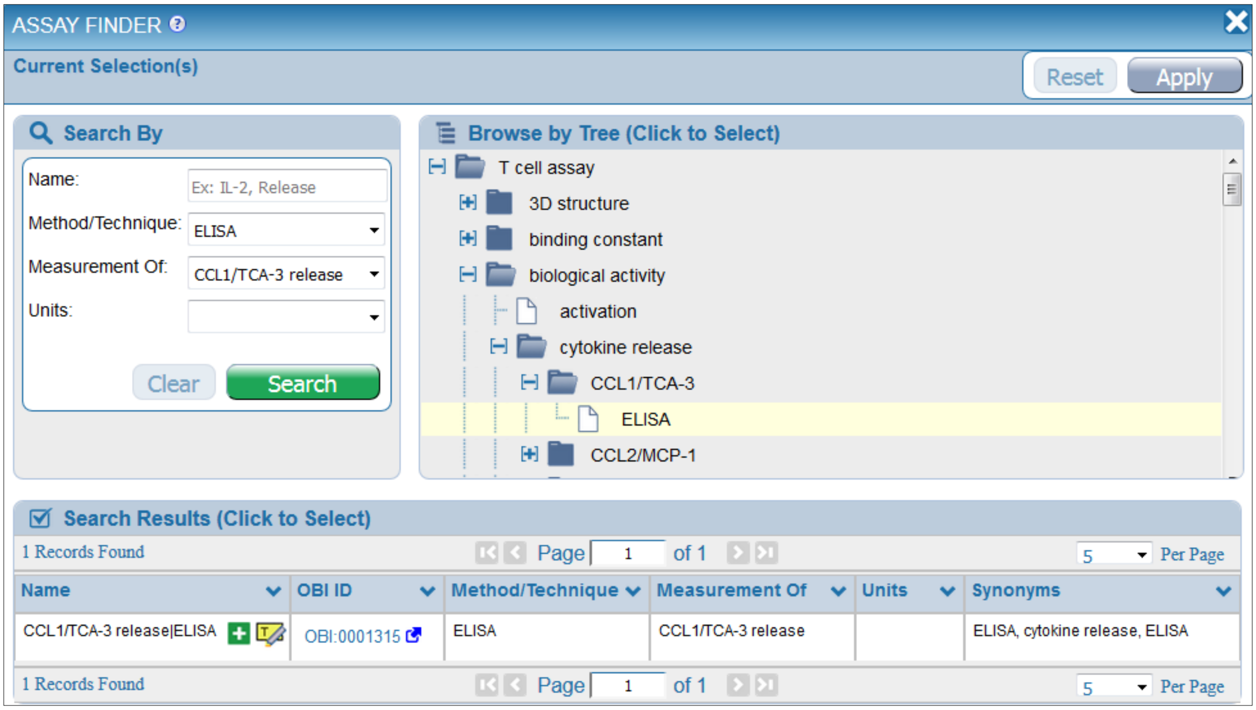
Name	Type	Organism	Class	Locus	Haplotype	Serotype
bonobo	class	bonobo (Pan paniscus)	MHC class I			
Papa-A*06:01	complete molecule	bonobo (Pan paniscus)	MHC class I	A		
Papa-A	locus	bonobo (Pan paniscus)	MHC class I	A		

Figure 2.28 Allele Finder. Alleles are displayed in a tree structure and users can sdearch by allele name, source organism, and MHC class (I, II, or non-classical)

2.2.4.2 Assay Finder

The IEDB contains experimental data characterizing antibody and T cell epitopes studied in humans, non-human primates, and other animal species. Search results may easily be narrowed to include only the specific assay categories of T Cell Assays, B Cell Assays, and MHC Ligand Assays. Additionally, one may further narrow search results to very specific experimental methods using the Assay Finder.

The Assay Finder is used to facilitate the selection of one or more assay types and lists all assay types in the selected assay category. The Assay Finder for T Cell, B cell, and MHC Ligand assays can be found in the Assay section on the the home page search interface, the left-hand side of the Results page, and on their respective Specialized Search pages. These versions of the Assay Finder organize and display assays in a tree structure, as seen in Figure 2.29 for the T Cell assays. Users can also search for assays by their method/technique and by the characters within the assay's name. The figure shows the results for ELISA type assays for "CCL1/TCA-3 release". Users can click on the green "+" icon to select an assay. Users can also click on the yellow highlighter icon to highlight the assay in the assay tree in the middle right section of the finder, as is shown in the figure. Alternatively, a user can browse the hierarchical assay tree. Clicking on a node in this tree will add the assay to the Current Selections section of the finder.



Name: Ex: IL-2, Release
Method/Technique: ELISA
Measurement Of: CCL1/TCA-3 release
Units:

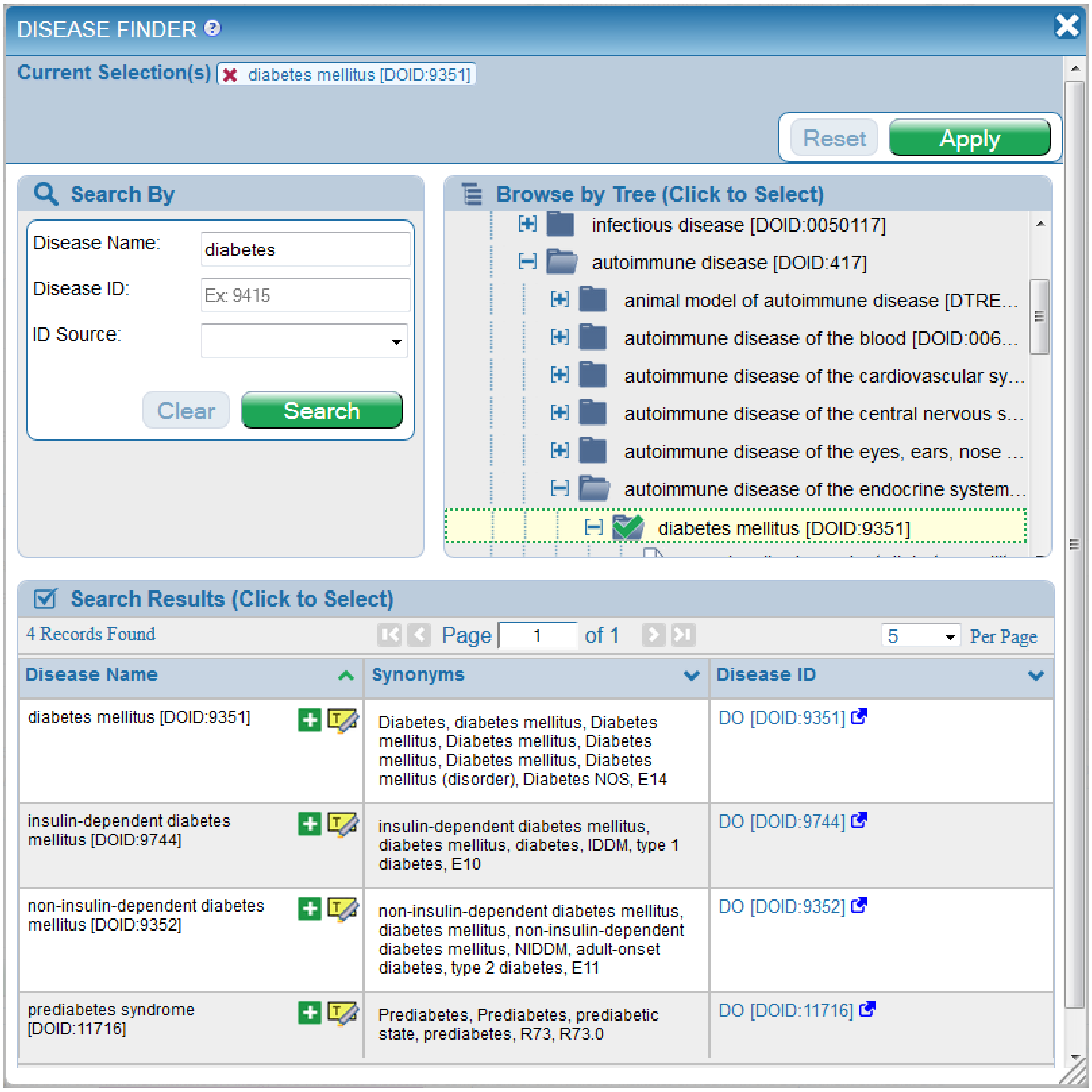
Name	OBI ID	Method/Technique	Measurement Of	Units	Synonyms
CCL1/TCA-3 release|ELISA	OBI:0001315	ELISA	CCL1/TCA-3 release		ELISA, cytokine release, ELISA

Figure 2.29 Assay Finder on the T Cell Advanced Search page. Assays are displayed in a tree structure and users can find displays by their method/technique and by the characters with which the assay name starts

2.2.4.3 Disease Finder

This query feature allows users to select a disease association based on the host disease state or status as captured in curation. Diseases are organized into a browsable tree structure. Upon the selection of host disease state/status, the system provides the user with a hierarchical *Disease Tree* that organizes the data at the highest level according to the five disease categories (Allergy, Autoimmunity, Infectious Disease, Additional Diseases by category, and Transplant-related Disease and Allo-reactivity) and then by the anatomical location of the disease (e.g. respiratory tract, gastrointestinal tract). In this way the user can either type in the disease name or synonym of interest, or navigate the Disease Tree by disease manifestation and physical location to see what is available. A node for healthy subjects is also included. The Disease Finder is fully functional for only Autoimmunity. The finder will be revised with an updated disease ontology and hierarchical tree during 2017 based on the Disease Ontology that will make it functional for the other disease categories. Infectious disease searches are best accommodated using the Organism Finder to specify the antigen.

Figure 2.30 shows the Disease Tree with diabetes highlighted. DOID refers to the Disease Ontology identifier. The DTREE designates an IEDB-specific identifier that will be updated later with a DOID number when the Disease Ontology incorporates the terms.



Current Selection(s): diabetes mellitus [DOID:9351]

Disease Name: diabetes

Disease ID: Ex: 9415

ID Source:

- infectious disease [DOID:0050117]
- autoimmune disease [DOID:417]
  - animal model of autoimmune disease [DTRE...
  - autoimmune disease of the blood [DOID:006...
  - autoimmune disease of the cardiovascular sy...
  - autoimmune disease of the central nervous s...
  - autoimmune disease of the eyes, ears, nose ...
  - autoimmune disease of the endocrine system...
    - diabetes mellitus [DOID:9351]

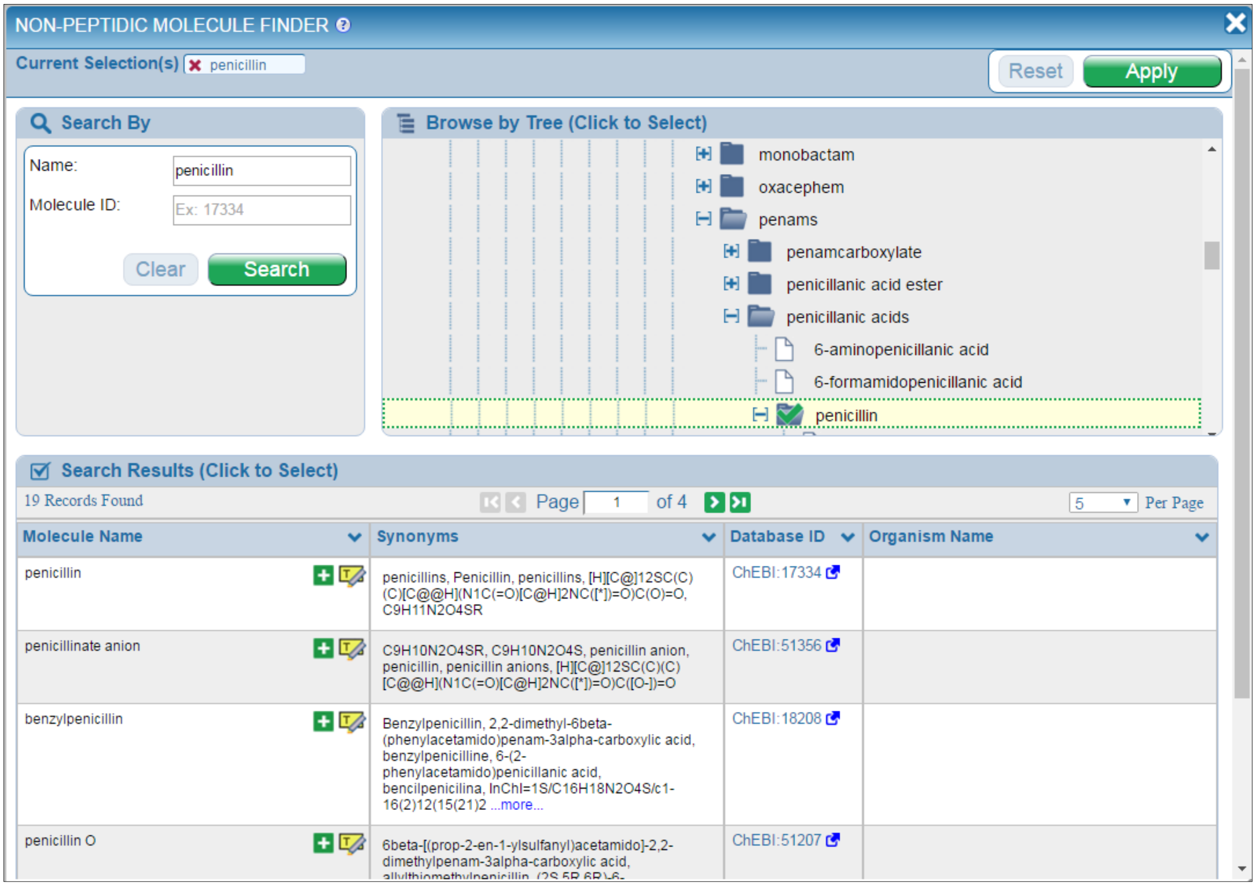
4 Records Found — Page 1 of 1 — 5 Per Page

Disease Name	Synonyms	Disease ID
diabetes mellitus [DOID:9351]	Diabetes, diabetes mellitus, Diabetes mellitus, Diabetes mellitus, Diabetes mellitus, Diabetes mellitus, Diabetes mellitus (disorder), Diabetes NOS, E14	DO [DOID:9351]
insulin-dependent diabetes mellitus [DOID:9744]	insulin-dependent diabetes mellitus, diabetes mellitus, diabetes, IDDM, type 1 diabetes, E10	DO [DOID:9744]
non-insulin-dependent diabetes mellitus [DOID:9352]	non-insulin-dependent diabetes mellitus, diabetes mellitus, non-insulin-dependent diabetes mellitus, NIDDM, adult-onset diabetes, type 2 diabetes, E11	DO [DOID:9352]
prediabetes syndrome [DOID:11716]	Prediabetes, Prediabetes, prediabetic state, prediabetes, R73, R73.0	DO [DOID:11716]

Figure 2.30 The disease finder is particularly helpful in specifying epitopes related to autoimmune diseases. In the example shown, diabetes is highlighted and selected.

2.2.4.4 Molecule Finder

The Molecule Finder is used to facilitate the selection of source antigens, immunogens, and epitopes. There are two versions of the Molecule Finder – one specifically for non-peptidic molecules found in the Epitope box in the results page, and another that includes peptidic and non-peptidic branches, found in the Antigen box in the results page. The former contains the structures curated by the Chemical Entities of Biological Interest (ChEBI) database. An example of the non-peptidic finder is shown in Figure 2.31.


NON-PEPTIDIC MOLECULE FINDER

Current Selection(s): penicillin

Search By

Name: penicillin

Molecule ID: Ex: 17334

Browse by Tree (Click to Select)

- monobactam
- oxacephem
- penams
  - penamcarboxylate
  - penicillanic acid ester
  - penicillanic acids
    - 6-aminopenicillanic acid
    - 6-formamidopenicillanic acid
    - ☑ penicillin

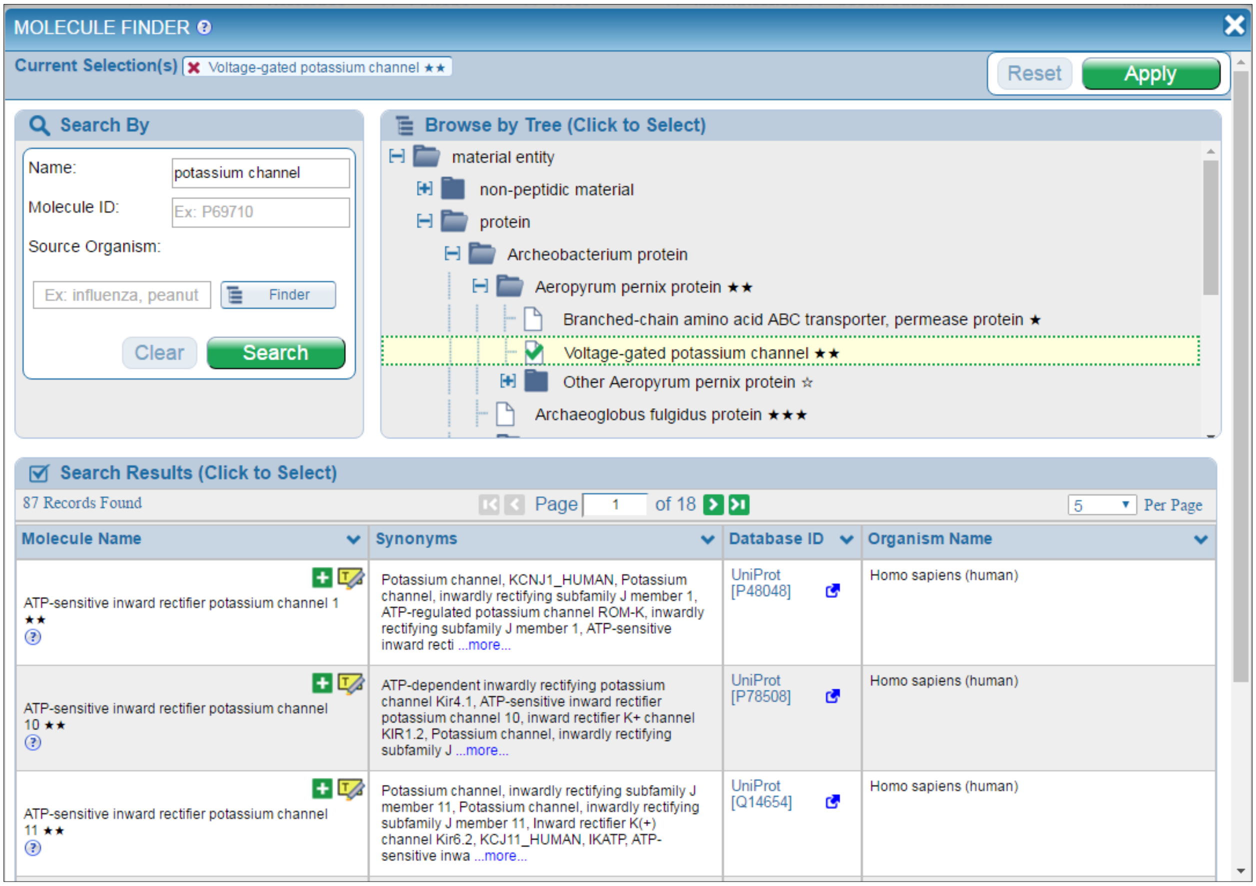
Search Results (Click to Select)

19 Records Found — Page 1 of 4 — 5 Per Page

Molecule Name	Synonyms	Database ID	Organism Name
penicillin	penicillins, Penicillin, penicillins, [H][C@]12SC(C)(C)[C@@H](N1C(=O)[C@H]2NC([*])=O)C(O)=O, C9H11N2O4SR	ChEBI:17334	
penicillinate anion	C9H10N2O4SR, C9H10N2O4S, penicillin anion, penicillin, penicillin anions, [H][C@]12SC(C)(C)[C@@H](N1C(=O)[C@H]2NC([*])=O)C([O-])=O	ChEBI:51356	
benzylpenicillin	Benzylpenicillin, 2,2-dimethyl-6beta-(phenylacetamido)penam-3alpha-carboxylic acid, benzylpenicilline, 6-(2-phenylacetamido)penicillanic acid, bencilpenicilina, InChI=1S/C16H18N2O4S/c1-16(2)12(15(21)2 ...more...	ChEBI:18208	
penicillin O	6beta-[(prop-2-en-1-ylsulfanyl)acetamido]-2,2-dimethylpenam-3alpha-carboxylic acid, allylthiomethylpenicillin, (2S,5R,6R)-6-	ChEBI:51207	

Figure 2.31 The non-peptidic version of the Molecule Finder. This finder is accessed in the Epitope filter on the search results page.

With regard to the protein or peptidic branch of the Molecule Finder, individual GenPept proteins utilized by IEDB data are assigned to parent proteins from reference proteomes by sequence homology. These reference proteomes are graded by a star system described below that reflects the quality and completeness of each. An example of the star system and the protein tree can be seen in Figure 2.32.



Current Selection(s) Voltage-gated potassium channel ★★

Name: potassium channel

Molecule ID: Ex: P69710

- material entity
  - non-peptidic material
  - protein
    - Archeobacterium protein
      - Aeropyrum pernix protein ★★
        - Branched-chain amino acid ABC transporter, permease protein ★
        - ☑ Voltage-gated potassium channel ★★
        - Other Aeropyrum pernix protein ☆
      - Archaeoglobus fulgidus protein ★★★

87 Records Found

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Molecule Name	Synonyms	Database ID	Organism Name
ATP-sensitive inward rectifier potassium channel 1 ★★	Potassium channel, KCNJ1_HUMAN, Potassium channel, inwardly rectifying subfamily J member 1, ATP-regulated potassium channel ROM-K, inwardly rectifying subfamily J member 1, ATP-sensitive inward recti ...more...	UniProt [P48048]	Homo sapiens (human)
ATP-sensitive inward rectifier potassium channel 10 ★★	ATP-dependent inwardly rectifying potassium channel Kir4.1, ATP-sensitive inward rectifier potassium channel 10, inward rectifier K+ channel KIR1.2, Potassium channel, inwardly rectifying subfamily J ...more...	UniProt [P78508]	Homo sapiens (human)
ATP-sensitive inward rectifier potassium channel 11 ★★	Potassium channel, inwardly rectifying subfamily J member 11, Potassium channel, inwardly rectifying subfamily J member 11, Inward rectifier K(+) channel Kir6.2, KCJ11_HUMAN, IKATP, ATP-sensitive inwa ...more...	UniProt [Q14654]	Homo sapiens (human)

Figure 2.32 An example of the protein branch of the Molecule Finder

Proteomes

★★★ For some well-studied species UniProt provides reference proteomes that contain a full set of all proteins expressed by the species. For some bacterial species having inconsistent protein expression, additional proteins have been added to the reference proteome to create metaproteomes. These reference proteomes or metaproteomes are designated by **three stars**.

★★ For other species that have been completely sequenced, UniProt provides complete proteomes. In addition, for some species expressing allergens, formal nomenclature designated by the International Union of Immunological Societies (IUIS) exists to describe these allergens. Complete proteomes that are not considered reference proteomes, or ones that contain formal IUIS allergen nomenclature for a subset of proteins, are designated by **two stars**.

★ For some species, a proteome does not currently exist in UniProt, but GenBank provides a set of proteins representative of the species. These GenBank proteomes are designated by a **single star**.

☆ For species that have no proteome in UniProt or GenBank, and no IUIS nomenclature, UniProt may still contain some records that can be used as parents. This case is designated with an **unfilled star**.

No Star. Species having no proteome in either UniProt or GenBank are designated by **no stars**.

Proteins

Within each species' proteome, individual, "parent" proteins serve to group multiple distinct GenPept sequences. These GenPept entries are the "children" for each proteome protein in the Molecule Tree. This allows users to search IEDB data by selecting the parent protein from the reference proteome, rather than having to select each individual GenPept entry. The "parent" proteins within each proteome also use stars to denote the quality of information provided by each.

★★ UniProt reviewed proteins or proteins having official IUIS allergen nomenclature have **two stars**.

★ UniProt unreviewed proteins or proteins from GenBank have a **single star**.

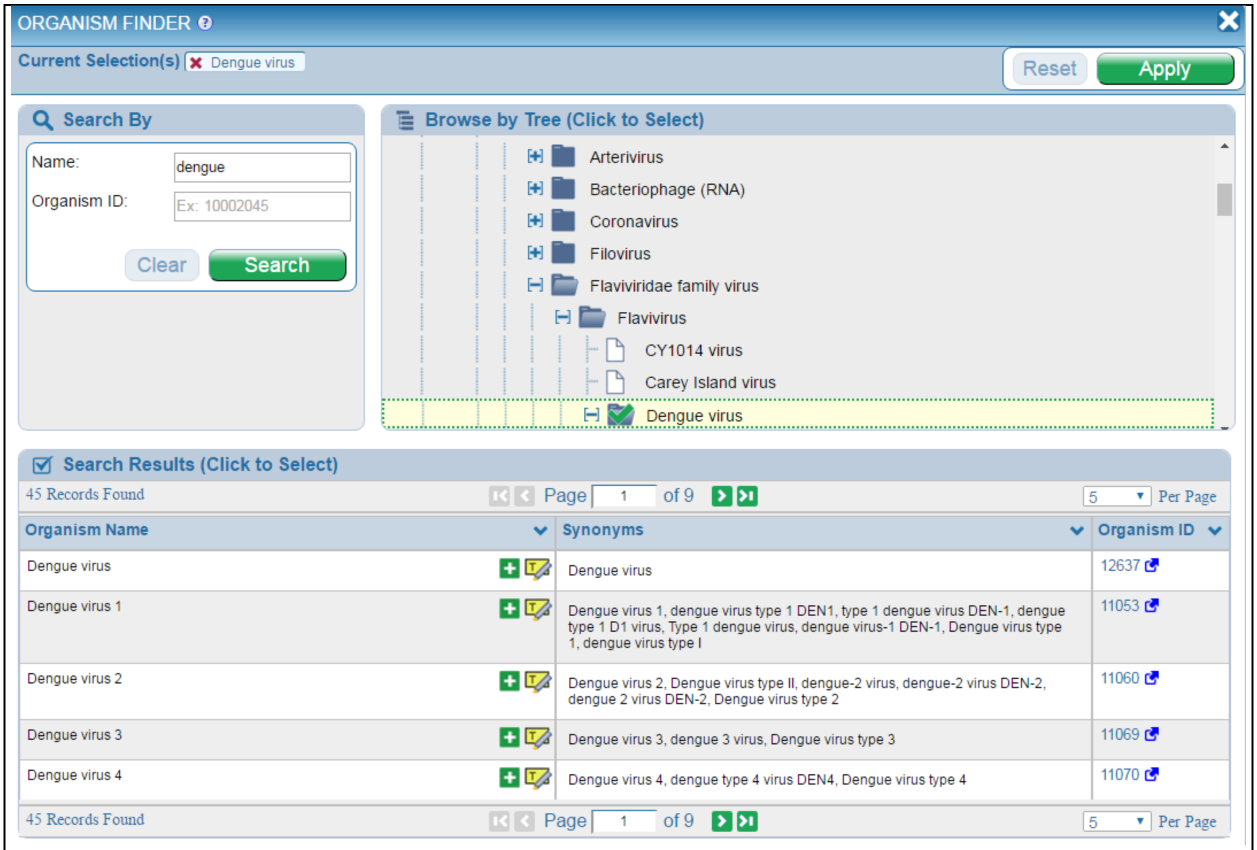
☆ Nodes of the protein branch of the molecule tree containing GenPept and IEDB internal protein accessions having no homology to any protein within a reference proteome are designated with an **unfilled star**.

Organizational nodes, utilized by the Molecule tree to clarify the relationship between groups of similar proteins have **no stars**. An example of these nodes is "Immunoglobulin" used to group all immunoglobulin proteins from a single species.

As one can see in Figure 2.29, a user can search the molecule tree by entering text, including synonyms, in the Name field in the upper lefthand corner of the finder. The user can also specify the source organism of the molecule of interest using the autocomplete field or the organism finder. For example, this can facilitate the specification of a hemagglutinin is a particular strain of Influenza.

2.2.4.5 Organism Finder

The organism finder is used to facilitate the selection of a species or strain from the NCBI Taxonomy Database. The Organism finder allows the user to find species using their name, synonyms, or taxonomy identifier (assigned by NCBI). When the user performs a search, the system will display a tree structure. The user can search for a name or Organism ID in the "Search By" panel in the upper lefthand portion of the Finder. In the example shown in Figure 2.33, a search for "dengue" is performed, which results in 45 items being found. The user can select one or more of the items by clicking on the green "+" icon or clicking a branch in the tree. The user can also choose to highlight the item in the tree, as shown in the figure, by clicking the corresponding yellow highlighter icon. Synonyms for a selection are listed next to the organism name column in the search results table. When the Organism Finder is adjacent to a Host Organism field, only the source organisms for which data exist in the IEDB are displayed in the tree structure.



Current Selection(s) ✖ Dengue virus

Name: dengue

Organism ID: Ex: 10002045

- Arterivirus
- Bacteriophage (RNA)
- Coronavirus
- Filovirus
- Flaviviridae family virus
  - Flavivirus
    - CY1014 virus
    - Carey Island virus
    - ✓ Dengue virus

45 Records Found · Page 1 of 9 · 5 Per Page

Organism Name	Synonyms	Organism ID
Dengue virus	Dengue virus	12637
Dengue virus 1	Dengue virus 1, dengue virus type 1 DEN1, type 1 dengue virus DEN-1, dengue type 1 D1 virus, Type 1 dengue virus, dengue virus-1 DEN-1, Dengue virus type 1, dengue virus type I	11053
Dengue virus 2	Dengue virus 2, Dengue virus type II, dengue-2 virus, dengue-2 virus DEN-2, dengue 2 virus DEN-2, Dengue virus type 2	11060
Dengue virus 3	Dengue virus 3, dengue 3 virus, Dengue virus type 3	11069
Dengue virus 4	Dengue virus 4, dengue type 4 virus DEN4, Dengue virus type 4	11070

45 Records Found · Page 1 of 9 · 5 Per Page

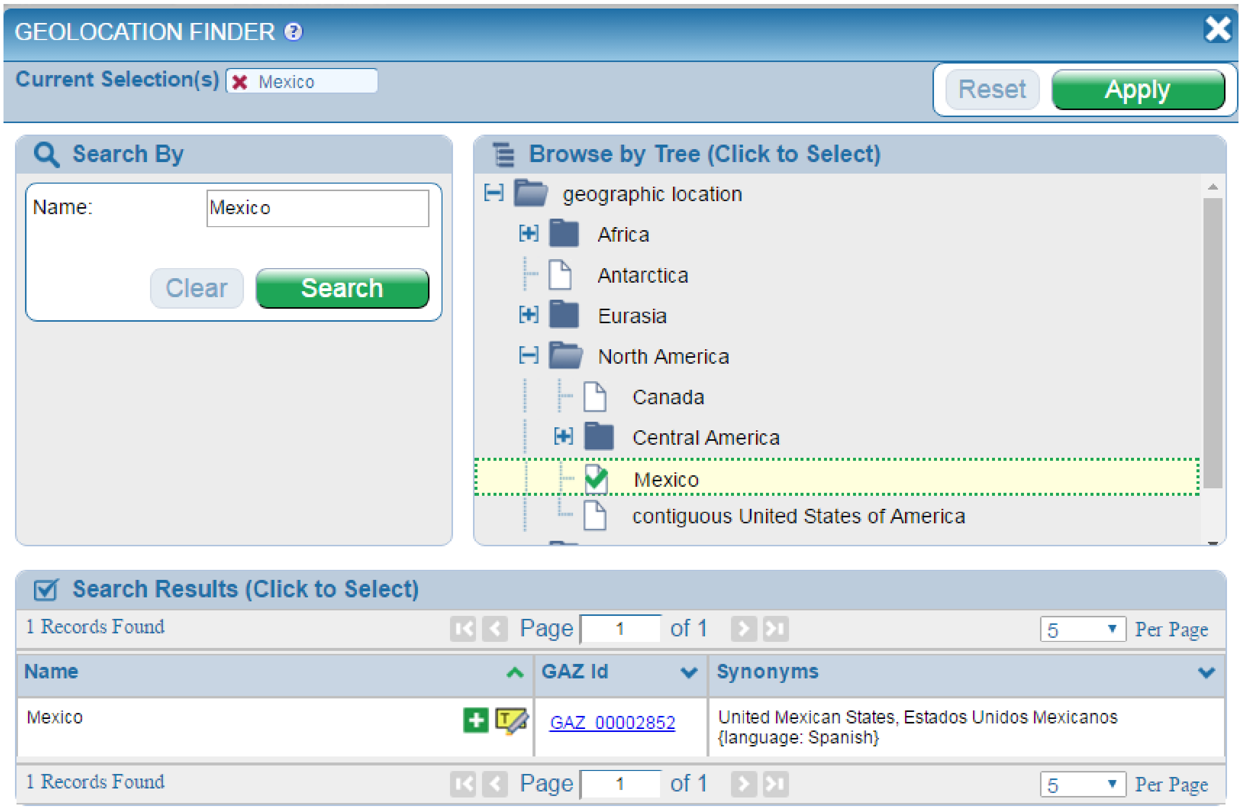
Figure 2.33 Organism Finder showing a search for dengue with dengue highlighted in the tree

2.2.4.6 Geolocation Finder

This feature combines the locations where study subjects were studied and the external ontology known as Gazetteer (http://bioportal.bioontology.org/ontologies/1397). It can be found on the B Cell Search, T Cell Search, and MHC Ligand Specialized search pages under the Host Details subsection within the Immunization section. Gazetteer represents geographic locations in a formal ontological hierarchy. The IEDB's Geographic Location Finder was created by taking the geographic locations mentioned in the manuscripts containing data curated by the IEDB and presenting them in the formal ontological hierarchy of Gazetteer. Thus, every geographic location in the Finder links out to a GAZ ID, where additional information provided by Gazetteer such as definitions and synonyms can be found.

To use the Finder, simply navigate the tree by clicking open the continent of choice to find the country(ies) where study subjects were exposed to the immunogen tested in the immune epitope assays. Alternatively, one may use the "Search By" feature and type free text to search the tree. The Search By feature accepts synonyms as search criteria. Its use is shown in Figure 2.34 for the term “Mexico”.

It must be noted that curators only capture geographic location information when authors explicitly state that subjects were recruited in a specific country. The location of authors' affiliations is not used to populate this field.



Current Selection(s): Mexico

Name: Mexico

1 Records Found

Name	GAZ Id	Synonyms
Mexico	GAZ_00002852	United Mexican States, Estados Unidos Mexicanos {language: Spanish}

1 Records Found

Figure 2.34 Geolocation finder. This example shows the tree structure by continent, region, and country. A search was made for Mexico within the tree using the Search By box on the left, which produced one result. This was then highlighted in the tree, as shown. Clicking on "Mexico" in the tree populated the Current Selection field in the upper left corner of the finder.

2.3 Tools

The Analysis Resource pull-down menu at www.iedb.org accesses the IEDB Analysis Resource and has five items – Analysis Resource Overview, T Cell Epitope Prediction, B Cell Epitope Prediction, Epitope Analysis Tools, and Tool Licensing Information. The purpose of the Analysis Resource of the IEDB is to provide computational tools that enhance the value of the IEDB database to the user. Providing access to tools in one centralized location helps make users aware of available solutions to their problems. All of the information contained within the Analysis Resource, including analysis tools and algorithms developed by the IEDB staff, are freely available to the scientific community. For commercial entitites that wish to access the tools in-house, licensing information for the tools can be accessed from the pull-down menu. The Analysis Resource can also be accessed via the rightmost panel on the IEDB home page, although only the most frequently used tools are listed.

The tools provided in the analysis resource fall into two categories – prediction tools and analysis tools. Prediction tools extrapolate beyond data held in the database. They can be used to predict epitopes in protein sequences or predict properties of known epitopes, such as their MHC binding affinity. Analysis tools help extract and interpret data contained in the database.

For prediction tools, it is important to differentiate between the **tool** making predictions, and the **method** used to generate that tool, given a set of training data. For example, the artificial neural network method or approach, when trained on a particular data set, will yield a prediction tool. As the ANN method is trained on different data sets, different corresponding prediction tools will result. In this way, the ANN method can be used to develop an MHC class I prediction tool and a separate MHC class II prediction tool. These tools can be refined as more data are available for training. One benefit of the IEDB is that it allows implementing methods to automatically generate new prediction tools as the database grows.

The AR Labs concept was introduced in early 2016. Tools under AR Labs are experimental and are considered to be beta versions, not quite ready for production yet. They are intended for further research, updates and testing. This means they are functional, but the team is still actively developing on improving them and more substantial changes are expected in upcoming releases.

The next subsections will describe each prediction and analytical tool in more detail.

2.3.1 T Cell and B Cell Prediction Tools

Prediction tools can be subdivided into categories by what they predict. The current tools fall into the subcategories listed below:

- T cell epitopes – MHC class I and II binding prediction
- T cell epitopes – Processing prediction
- T cell epitopes – Immunogenicity prediction
- B cell epitope prediction
- Structure tools

2.3.1.1 T Cell Epitopes - MHC binding prediction

The Analysis Resource provides tools for predicting peptide binding to MHC class I and II molecules. For class I binding predictions, users can select predictions performed with tools derived from ten different methods – IEDB Recommended, artificial neural network (ANN), stabilized matrix method (SMM), SMM with a peptide:MHC binding energy covariance matrix (SMMPMBEC), Scoring matrices derived from combinatorial peptide libraries (Comblib_Sidney2008), Consensus, NetMHCpan, PickPocket, NetMHCcons, and NetMHCstabpan. The Consensus method is derived from the ANN, SMM, and CombLib methods. For class II binding predictions, users can select IEDB Recommended, the Combinatorial Library method, the NN_align, the SMM_align method, a method devised by Sturniolo et al. and used in TEPITOPE, NetMHCIIpan, and a consensus method derived from the NN-align, SMM_align, Sturniolo methods, and the Combinatorial Library. Tutorials and example data are available for both the class I and II tools.

A RESTful interface is available for the MHC class I and class II prediction tools. This allows users to perform predictions on the IEDB server in batch mode without having to install any software on their own systems. Additionally, users will always be assured that they are using the latest version of the tools. More information is available in Section 2.3.5. These tools are also available in standalone form on the Download tab and can be downloaded at http://tools.iedb.org/main/download/.

2.3.1.1.1 Peptide Binding to MHC Class I Molecules

Users can select from ten different methods for predicting class I epitopes – ANN, SMM, SMMPMBEC, Comblib_Sidney2008, Consensus, NetMHCpan, NetMHCcons, PickPocket, NetMHCstabpan, and IEDB recommended, which are described further below. A check box can be used to show only frequently occurring alleles. This allows the selection of only those alleles that occur in at least 1% of the human population or allele frequency of 1% or higher. However, un-checking the check-box will allow selection of all the alleles and corresponding peptide lengths for a particular species. Users can also upload an allele file instead of entering allele on the page one at a time.

Artificial Neural Network

Artificial neural networks (ANN) are computer algorithms modeled after the brain. They consist of many simple processing units which are wired together in a communication network. Each unit is a simplified model of a neuron which sends off a new signal if it receives a sufficiently strong input signal from the other units to which it is connected. The strength of these connections can be varied in order for the network to perform a desired pattern of node signal activity, which is learned from a set of input training data.

ANNs have been trained for 81 different Human MHC alleles including HLA-A, -B, -C and -E. Furthermore, predictions for 41 animal (Monkey, Cattle, Pig, and Mouse) alleles are available. The current version of ANN is based on NetMHC 4.0. The method is describe in Nielsen et al. (Protein Science, 2003) and Andreatta and Nielsen (Bionformatics, 2016).

Stabilized Matrix Method (SMM)

The Stabilized Matrix Method (SMM) described by Peters and Sette (BMC Bioinformatics, 2005) can be applied to calculate matrices from quantitative affinity data of peptides binding to MHC molecules. The advantage of this method is that it suppresses the noise present in the training data, caused by the inevitable experimental error as well as the limited number of data points.

Stabilized matrix Method with a Peptide:MHC Binding Energy Covariance matrix (SMMPMBEC)

SMMPMBEC is an improved version of SMM. It is different from SMM in that it addresses sparseness of peptide sequence coverage that is often found in binding data sets by using Peptide:MHC Binding Energy Covariance (PMBEC). The PMBEC matrix was derived from experimentally determined binding affinity measurements using combinatorial peptide libraries. SMMPMBEC is described in Kim et al. BMC Bioinformatics 2009.

Scoring matrices derived from combinatorial peptide libraries (Comblib_Sidney2008)

Comblib_Sidney2008 refers to a set of predictors (i.e. scoring matrices) that were derived from binding affinity measurements of combinatorial peptide libraries against a panel of MHC alleles. This work is described in Sidney et al. (Immunome Res. 2008). This class of predictors is unique in that average binding energy contribution of a given residue at a position is directly measured, without worrying about limited peptide sequence coverage.

Consensus

The Consensus predictor was motivated by an idea that predictions made by consulting "consensus" of individual predictions from multiple predictors may result in improved performance over that of any individual ones. For MHC-I, a work describing an early implementation can be found in Moutaftsi M et al. (Nat Biotech 2006). The methods used for Consensus are ANN, SMM, and CombLib_Sidney2008. The Consensus method uses as many of these three component methods as possible, depending on their applicability for the chosen allele and length.

NetMHCpan

NetMHCpan version 4.0 predicts binding of peptides to any MHC class I molecule of known sequence using artificial neural networks (ANNs). The method is trained on binding affinity and eluted ligand data leveraging the information from both data types as described in Jurtz et al. (J Immunol, 2017). To train this method, data on all class I MHC ligand elution assays available in IEDB database were collected including the ligand sequence, details of the source protein, position of the ligand in the source protein and the restricting allele of the ligand. There were 160,527 distinct assays in total and the length of the ligands ranged from 4–37. All lengths with a count of ligands at least 0.5% of total ligands were selected for further analysis which included lengths 8–15 and comprised of 99% of the assay entries. After refinement described in Jurtz et al. (J Immunol, 2017), the final training data set had 85,217 entries in total with ligand length ranging from 8 to 15. The ligands originated from 14,797 source antigens and were restricted by 55 unique HLA molecules. Random artificial negatives were generated for each MHC molecule covered by eluted ligand data by sampling randomly 10*N peptides of each length 8–15 amino acids from the antigen source protein sequences, where N is the number of 9mer ligands for the given MHC molecule.

PickPocket

PickPocket predicts binding of peptides to any known MHC molecule using positiion specific weight matrices. The method is trained on more than 150,000 quantitative binding data covering more than 150 different MHC molecules. Predictions can be made for HLA-A, B, C, E and G alleles, as well as for non-human primates, mouse, cattle, and pig. Version 1.1 has been retrained on extented data set including 10 prevalent HLA-C and 7 prevalent BoLA MHC-I molecules. The matrices of pocket-library are generated using the SMM_pmbec method described in Kim et al. (BMC Bioinformatics, 2009). Predictions can be made for 8 – 12mer peptides. All non-9mer predictions are made using approximations. The prediction values are given in nM IC50 values. The algorithm is described in Zhang et al. (Bioinformatics, 2009).

NetMHCcons

NetMHCcons predicts binding of peptides to any known MHC class I molecule. This is a consensus method for MHC class I predictions integrating three state-of-the-art methods, NetMHC, NetMHCpan, and PickPocket, to give the most accurate predictions. NetMHC is an artificial neural network-based (ANN) allele-specific method which has been trained using 94 MHC class I alleles. Version 3.4 is used as part of NetMHCcons-1.1. NetMHCpan is a pan-specific ANN method trained on more than 115,000 quantitative binding data covering more than 120 different MHC molecules. Version 2.8 is used as part of NetMHCcons-1.1. PickPocket Version 1.1 is described above. NetMHCcons can generate predictions for peptides of 8 – 15 residues in length. The prediction values are given in nM IC50 values. The method is described in detail in Karosiene et al. (Immunogenetics, 2012).

NetMHCstabpan

NetMHCstabpan was introduced in 2016. It predicts binding stability of peptides to any known MHC molecule using artificial neural networks (ANNs). The method is trained on more than 25,000 quantitative stability data covering 75 different HLA molecules. The user can upload full length MHC protein sequences, and have the server predict MHC restricted peptides from any given protein of interest. Predictions can be made for 8-14 mer peptides, although all non 9mer predictions are made using approximations. Most HLA molecules have a strong preference for binding 9mers. The prediction values are given in half life time in hours values and as %-Rank to a set of 200,000 random natural peptides. The method is described in Rasmussen et al. (Journal of Immunology, 2016).

IEDB Recommended
IEDB recommended is the default prediction method selection. It considers all alleles and their corresponding peptide lengths for a particular species. For each allele-length combination, consensus method is used, which includes ANN, SMM, and CombLib. If none of these methods are available for the allele, NetMHCpan is used.

2.3.1.1.2 Peptide Binding to MHC Class II Molecules

Users can select from seven different methods for predicting class II epitopes – IEDB recommended, SMM-align, Sturniolo, Combinatorial Library, Consensus, NN-align, and NetMHCIIpan. By default, the overall best method (IEDB recommended) is selected. However, not all methods can currently make predictions for all alleles, so only the alleles available will be displayed. The seven methods are described further below.

SMM-align
The MHC class II binding groove is open at both ends making the correct alignment of a peptide in the binding groove a crucial part of identifying the core of an MHC class II binding motif. The stabilization matrix alignment method, SMM-align, allows for direct prediction of peptide:MHC binding affinities. The method uses amino terminal peptide flanking residues (PFR) to get a consistent gain in predictive performance by favoring binding registers with a minimum PFR length of two amino acids. The method predicts quantitative peptide:MHC binding affinity values. The method has been trained and evaluated on a data set that covers the nine HLA-DR supertypes suggested and three mouse H2-IA allele. The method is described by Nielsen et al. (BMC Bioinformatics, 2007).

Sturniolo
This matrix-based approach is used in the TEPITOPE class II epitope prediction program. It is described in Sturniolo et al. (Nat. Biotechnol., 1999).

Combinatorial Library
The positional scanning combinatorial libraries approach utilized a pool of random peptide libraries to systematically measure the contribution to MHC binding from each amino acid at each of the nine positions at the binding peptide. Each pool in the library contains 9-mer peptides with one fixed residue at a single position. With each of the 20 naturally occurring residues represented at each position along the 9-mer backbone, the entire library consisted of 180 peptide mixtures. Competitive binding assays were then carried out to determine the IC50 values for each pool. IC50 values for each mixture were standardized as a ratio to the geometric mean IC50 value of the entire set of 180 mixtures, and then normalized at each position so that the value associated with the optimal value at each position corresponds to 1. For each position, an average (geometric) relative binding affinity (ARB) was calculated, and then the ratio of the ARB for the entire library to the ARB for each position was derived. The final results are a set of 9 by 20 scoring matrices which could predict the binding of novel peptides to MHC molecules.

The methodology is the same as that used for the MHC class I combinatorial library tool as described in Sidney et al. Immunome Res. 2008. A description of the ARB method is contained in Bui et al., Immunogenetics, 2005.

Consensus

The consensus method was developed by the IEDB team by exploiting features of three aforementioned methods. The Consenus method uses NN-align, SMM-align, and the combinatorial peptide scanning library. When the scanning library is not available for an allele, the Sturniolo method is used instead. A paper describing the original method was published by Wang et al. (PLoS Comput Biol, 2008), and a subsequent paper was published by Wang et al. (BMC Bioinformatics, 2010). The datasets used in assessing the performance of the NN-align, SMM-align, and Sturniolo methods and in developing the Consensus method, as described in Wang et al. (2010), can be found at http://tools.iedb.org/main/datasets/.

NN-align
NN-align is an artificial neural network-based alignment algorithm for MHC class II peptide binding prediction. It simultaneously identifies the MHC class II binding core and binding affinity. The method is trained using an algorithm that corrects bias in the training data caused by redundancy in binding core representation. Prediction accuracy has been shown to improve significantly when information about the residues flanking the peptide-binding core is taken into account. A 2009 paper in BMC Bioinformatics by Nielsen and Lund describes the method in detail (PMID: 19765293).

NetMHCIIpan
NetMHCIIpan predicts binding of peptides for all three human MHC class II isotypes- HLA-DR, HLA-DP, and HLA-DQ, in addition to mouse H-2-I molecules. A paper describing the method was published by Nielsen et al. in PLoS Computational Biology, 2008, and a paper describing the latest version 3.1 was published by Andreatta et al. in Immunogenetics, 2015.

IEDB Recommended
IEDB recommended is the default prediction method selection. It considers all alleles and their corresponding peptide lengths for a particular species. For each allele-length combination, consensus method is used, as described above. If none of these methods are available for the allele, NetMHCIIpan is used.

2.3.1.1.3 Tepitool

The tool is designed as a wizard for the prediction of T cell epitope candidates from a given set of amino acid sequences, based on predicted peptide binding to MHC class I and class II molecules, where the user is led through a series of well-defined steps to complete the task. In contrast to the independent methods described above, Tepitool guides the user step-by-step as a client-side web form that takes user input data that is in turn processed at the server-side when the user submits the entire form. All fields except sequences and alleles are filled with default recommended settings for prediction and selection of optimum peptides. The input parameters can be adjusted as per the user's specific needs, and the user can go back to previous steps to change the selection before final submission of the job. The TepiTool has six steps:

(i) Provide sequence data.
(ii) Select the host species and MHC allele class.
(iii) Select the alleles for binding prediction.
(iv) Select peptides to be included in prediction.
(v) Select preferred methods for binding prediction and peptide selection and cutoff values.
(vi) Review selections, enter job details and submit data.

The tool is described in Paul et al. (Curr. Protoc. Immunol., 2016).

2.3.1.2 T Cell Epitopes – MHC I Processing Prediction

2.3.1.2.1 Proteasomal cleavage/TAP transport/MHC class I combined predictor

For the prediction of antigen processing through the MHC class I antigen presentation pathway, we incorporated predictions of proteasomal cleavage and TAP transport similar to the MHCPathway website described in (Tenzer et al, CMLS, 2005). The predictions are based on in vitro experiments characterizing the sequence specificity of proteasomal cleavage and TAP transport. The goal of the prediction is to identify MHC-I ligands (peptides that are naturally processed from their source proteins and presented by MHC class I molecules).

The proteasomal cleavage predictions evaluate how efficiently a peptide or its N-terminally prolonged precursors can be liberated from its source protein. The TAP transport predictions evaluate how efficiently a peptide or its N-terminal prolonged precursors are transported into the ER by TAP (Peters et al., Immunol, 2003). When this information is taken together and combined with MHC class I binding predictions, the tool yields a prediction of the efficiency with which a peptide is presented on the cell surface. The methods available are ANN, SMM, SMMPMBEC, Comblib_Sidney2008, NetMHCpan, PickPocket, NetMHCcons, and IEDB Recommended, which are described in Section 2.3.1.1.1.

A check box can be used to show only frequently occurring alleles. This allows the selection of only those alleles that occur in at least 1% of the human population or allele frequency of 1% or higher. However, un-checking the check-box will allow selection of all the alleles and corresponding peptide lengths for a particular species. Users can also upload an allele file instead of entering allele on the page one at a time.

2.3.1.2.2 Neural network based prediction of proteasomal cleavage sites (NetChop) and T cell epitopes (NetCTL/NetCTLpan)

NetChop produces neural network predictions for cleavage sites of the human proteasome (Kesmir et al., 2002). NetChop takes into account the characteristics of the structurally modified proteasomes found in cells stimulated by gamma-interferon under physiological conditions. The NetChop algorithm was trained on in vitro data and MHC Class I ligand data. The use of this training set, combined with the artificial neural network methodology, makes the prediction of cleavage sites more accurate. NetChop has been trained only on human data, but since the proteasome structure is quite conserved, the algorithm developers believe that the tool is capable of making reliable predictions for at least the other mammalian proteasomes.

NetCTL predicts CTL epitopes in protein sequences integrating prediction of peptide MHC binding, proteasomal C terminal cleavage and TAP transport efficiency. The method is described in detail in Larsen et al. (Eur J Immunol., 2005). NetCTLpan is an update to the original NetCTL server that allows for prediction of CTL epitope with restriction to any MHC molecules of known protein sequence (Stranzl et al., Immunogenetics, 2010). This tool is also available in a standalone form on the Download tab and can be downloaded at http://tools.iedb.org/main/download/.

2.3.1.2.3 MHC-NP: Prediction of peptides naturally processed by the MHC

MHC-NP is a tool for predicting peptides naturally processed by the MHC pathway and was introduced to the Analysis Resource in 2013. MHC-NP employs data obtained from MHC elution experiments in order to assess the probability that a given peptide is naturally processed and binds to a given MHC molecule. This tool was the winner of the 2nd Machine Learning Competition in Immunology, where it yielded state-of-the-art accuracy for the prediction of peptides eluted from human HLA-A*02:01, HLA-B*07:02, HLA-B*35:01, HLA-B*44:03, HLA-B*53:01, HLA-B*57:01 and mouse H2-D(b) and H2-K(b) MHC molecules. The method is described in Giguère et al. (J Immunol Methods, 2013). Because the tool was developed by researchers external to the IEDB team, it is not included in the virtual machine image.

2.3.1.2.4 MHC-II-NP: Prediction of peptides naturally processed by the MHC

Although algorithms for the prediction of peptide binding affinity to MHC II molecules exist, there is a lack of methods that predict the ligands resulting from natural antigen processing. To address this gap MHC-II-NP was developed.

The training ligand dataset, obtained through IEDB database query, contained more than 14,000 naturally processed ligands identified by MS of peptides eluted from MHC class II-expressing cells (from approximately 2,600 unique protein sequences). Analysis into sequence signatures which liberate peptides from their source antigens revealed preferred amino acids surrounding both N- and C- ligand terminuses. These cleavage motifs were used to develop this method for predicting naturally processed MHC II ligands as described in Paul et al. (Front. Immunol., 2018).

2.3.1.3 T cell class I pMHC immunogenicity predictor

An MHC class I immunogenicity tool was introduced in 2013. T-cells have to recognize peptides presented on MHC molecules to be activated and elicit their effector functions. Several studies have demonstrated that some peptides are more immunogenic than others and therefore more likely to be T-cell epitopes. This tool is based on an analysis of a large set of data describing the immunogenicity of peptides presented on various MHC-I molecules.

Two main conclusions could be drawn from this analysis. First, in line with previous observations, the developers showed that positions P4-6 of a presented peptide are more important for immunogenicity. Second, some amino acids, especially those with large and aromatic side chains, are associated with immunogenicity. This information was combined into a simple model that was used to demonstrate that immunogenicity is, to a certain extent, predictable. This model was validated with data from two independent epitope discovery studies. This model indicated that T-cells are equipped to better recognize viral than human (self) peptides. The method is described in Calis et al. (PLoS Comput Biol., 2013). This tool is also available in a standalone form on the Download tab and can be downloaded at http://tools.iedb.org/main/download/.

2.3.1.4 Deimmunization

The deimmunization tool is attempt to identify immunodominant regions in a given therapeutically important protein, and suggest amino-acid substitutions that create non-immunogenic versions of the proteins. So we have opted a two steps process; 1) In the first step, the deimmunization tool will list all the immunogenic regions or peptides based on selected threshold. These peptides will be generated from the protein with 15mer window size and 10mer overlap. 2) In the second step, the user can select one or more peptides listed in the results and final result window will display the non-immunogenic substitution of each selected peptides. The default threshold is 8.5 (which is difference in the median of percentile rank from 26 reference alleles set for MHC class II). In the final result window, the tools will also take care of the fact that non-immunogenic substitution in the immunogenic peptides, should not create new immunogenic site in the neighboring peptides. Therefore, the result window will also display the effect of substitution on the neighboring peptides.

This tool is described in Dhanda et al. (Immunology, 2018).

2.3.1.5 CD4 T cell immunogenicity

The server is developed to predict the allele independent CD4 T cell immunogenicity at population level, overcoming complications related to the high level of variability of HLA molecules, potential other factors beyond HLA as well as a frequent lack of HLA typing data. With this tool, users can predict the T cell immunogenicity using 7-allele method (Paul et. al. 2015), immunogenicity method and combined method (IEDB recommended). The combined method predicts the final score that combines the predictions from 7-allele method and immunogenicity method.

This tool is described in Dhanda et al. (Front Immunol, 2018).

2.3.2 B Cell Epitope Prediction

2.3.2.1 Prediction of linear epitopes from protein sequence

Six different tools are provided that predict antibody epitope candidates from amino acid sequences. Five are based on amino acid property scales and a sixth method uses a Hidden Markov Model. Parameters such as hydrophilicity, flexibility, accessibility, and antigenic propensity of polypeptides chains have been correlated with the location of continuous epitopes in a few well-characterized proteins. Based on these observations, amino acid property scales have been developed to predict antigenic determinants. Each scale consists of 20 values assigned to each of the amino acid residues on the basis of their relative propensity to possess the property described by the scale. The following amino acid property scales have been selected and implemented based on their popularity and coverage of different categories.

- Secondary structure - Chou and Fasman beta turn prediction
- Surface exposure - Emini surface accessibility prediction
- Flexibility - Karplus and Schulz flexibility prediction
- Antigenicity - Kolaskar and Tongaonkar antigenicity prediction
- Hydrophobicity/hydrophilicity - Parker hydrophilicity prediction

BepiPred combines the predictions of a hidden Markov model and the propensity scale of Parker et al. (Biochemistry, 1986). It is described in Larsen et al. (Immunome Research, 2006). The linear B cell epitope predictor is also available as a standalone tool. In 2017, BepiPred 2.0 was developed and published (Nucleic Acids Res, 2017), PMID: 28472356. BepiPred-2.0 uses structural predictions, such as surface accessibility and secondary structure as part of the feature space. Using a Random Forest machine-learning algorithm trained on structural epitopes obtained from 160 3D-structures, they improved the performance significantly compared to the prior version and other state-of-the-art prediction tools.

2.3.2.2 DiscoTope - Prediction of epitopes from protein structure

DiscoTope was augmented in 2013 to include include version 2.0 as well as version 1.1. DiscoTope is designed specifically to predict discontinuous epitopes. It uses protein three-dimensional structural data in addition sequence data. The method is based on amino acid statistics, spatial information, and surface accessibility in a compiled data set of discontinuous epitopes determined by X-ray crystallography of antibody/antigen protein complexes. DiscoTope 2.0 works with a novel definition of the spatial neighborhood used to sum propensity scores and half-sphere exposure as a surface measure. The results are more accurate than version 1.1 but involve more complex calculations that increase run times by a factor of approximately 30.

DiscoTope 1.1 is described in Haste Andersen et al. (Protein Sci., 2006), and DiscoTope 2.0 is described in Kringelum et al. (PLoS Comp. Bio, 2012).

2.3.2.3 ElliPro - Epitope prediction based upon structural protrusion

ElliPro predicts linear and discontinuous antibody epitopes based on a protein antigen's 3D structure. ElliPro accepts either a protein structure (preferred) or a protein sequence as an input. If a protein sequence is used, ElliPro will predict its 3D structure by homology modeling. Its use if described in the Tutorial tab of the ElliPro section of the Analysis Resource. The method is described in Julia Ponomarenko et al. (BMC Bioinformatics, 2008). It is also available as a standalone tool.

2.3.2.4 LYmphocyte Receptor Automated modeling (LYRA)

The LYRA web server implements a complete and automated method for building of B- and T-cell receptor structural models starting from their amino acid sequence alone. The webserver is freely available and easy to use for non-specialists. Upon submission, LYRA automatically generates alignments using ad hoc profiles, predicts the structural class of each hypervariable loop, selects the best templates in an automatic fashion, and provides within minutes a complete 3D model that can be downloaded or inspected online. Experienced users can manually select or exclude template structures according to case specific information. LYRA is based on the canonical structure method, that in the last 30 years has been successfully used to generate antibody models of high accuracy, and in our benchmarks this approach proves to achieve similarly good results on TCR modeling, with a benchmarked average RMSD accuracy of 1.29 and 1.48 Å for B- and T-cell receptors, respectively.

2.3.2.5 Methods for modeling and docking of antibody and protein 3D structures

This web page provides information on methods for modeling and docking of antibody and protein 3D structures. The methods are available as web servers and are hosted outside the IEDB except one method, LYRA, described above. One of the approaches at B-cell epitope prediction involves antibody-antigen docking, or 3D modeling of an antibody-antigen complex, for known 3D structures of both antibody and antigen. When the structures of either antibody or protein or both are unknown (that is, not available in PDB) but sequences are known, the user can attempt to obtain the 3D structural models of the antibody and the antigen, following the chart displayed on the web page and using the described web servers. Links are provided to these servers for the user’s convenience.

2.3.3 Epitope Analysis Tools

2.3.3.1 Population coverage

T cells recognize a complex between a specific MHC type and a particular pathogen-derived epitope and thus a given epitope will elicit a response only in individuals that express an MHC molecule capable of binding that particular epitope. MHC molecules are extremely polymorphic (over a thousand different variants are known in humans). Therefore, selecting multiple peptides with different MHC binding specificities will afford increased coverage of the patient population targeted as vaccine recipients. The issue of population coverage in relation to MHC polymorphism is further complicated by the fact that different MHC types are expressed at dramatically different frequencies in different ethnicities. Thus, without careful consideration, a vaccine with ethnically biased population coverage could result. To address this issue, the actual/predicted binding capacity of potential epitopes to as many different MHC molecules possible (and when available, also restriction data of T cell responses recognizing the epitope) can be used to project the population coverage in different ethnicities of different vaccine candidates or epitope sets. Accordingly, epitope-based vaccines or diagnostics can be designed to maximize population coverage, while minimizing complexity (that is, the number of different epitopes included in the diagnostic or vaccine), and also minimizing the variability of coverage obtained or projected in different ethnic groups.

An important consideration in the process of epitope selection is that the patient population coverage afforded by a given set is not simply corresponding to the sum of the coverage of its individual components. Thus, to calculate the coverage afforded by a given mixture of epitopes, a more comprehensive approach and a suitable algorithm has been developed for this specific purpose (Bui et al. BMC Bioinformatics 2006). This method calculates the fraction of individuals predicted to respond to a given epitope set on the basis of HLA genotypic frequencies, assuming non-linkage disequilibrium between HLA loci, and on the basis of MHC binding and/or T cell restriction data. The algorithm is briefly explained here. First, genotypic frequencies of various MHC are tabulated. Each time a peptide binds to a given MHC, a "hit" is recorded for that MHC. The process is repeated for all peptides. Then the hits for MHC are tallied. Next, the frequency of each possible diploid MHC combination (phenotype) is calculated. For *n* MHC types, this corresponds to an *n* x *n* tabulation of the frequency at which each specific pair of MHCs will be found in the population from which the MHC frequencies are derived. A similar table is generated to contain the number of hits per each of the MHC combinations by adding the number of hits associated with each of the two alleles of MHC in the combination (a simple exception is the case of homozygous combinations, where the number of hits is simply the number of hits of the given MHC). From these two tables, a frequency distribution is assembled, tabulating the genotypic frequency of all MHC combinations associated with a certain number of hits. The result of the analysis is displayed as a frequency distribution histogram and a cumulative frequency plot.

HLA allele genotypic frequencies were obtained from Allele Frequency Net Database (http://www.allelefrequencies.net/). At present, Allele Frequency Net Database (Gonzalez-Galarza FF et al., Nucleic Acids Res. 2015) provides allele frequencies for 115 countries and 20 different ethnicities grouped into 16 different geographical areas. In addition, the program also accepts custom populations with allele frequencies defined by users. Multiple population coverages can be simultaneously calculated and an average population coverage is generated. Since MHC class I and MHC class II restricted T cell epitopes elicit immune responses from two different T cell populations (CTL and HTL, respectively), the program provides three calculation options to accommodate different coverage modes: (1) class I separate, (2) class II separate, and (3) class I and class II combined. For each population coverage, the tool computes the following: (1) projected population coverage, (2) average number of epitope hits / HLA combinations recognized by the population, and (3) minimum number of epitope hits / HLA combinations recognized by 90% of the population (PC90).

2.3.3.2 Epitope conservancy

In a diagnostic or epitope-based vaccine setting, focusing on conserved epitopes allows for targeting responses around pathogen variability, whether it exists prior to infection, or develops in the natural course of disease. The use of conserved epitopes would be expected to focus the immune response on sequences crucial for retaining biological function of the pathogen proteins, and thus with intrinsically lower variability, even under immune pressure. The epitope conservancy analysis tools implemented here aims to address the issue of variability (or conservation) of epitopes, and to assist in the selection of epitopes with the desired pattern of conservation. The algorithm has been implemented to calculate the degree of conservancy of an epitope within a given protein sequence set at different degree of identities. The degree of conservation is defined as the number of protein sequences that contain the epitope at a given identity level, divided by the total number of protein sequences found in the dataset analyzed (Bui et al. BMC Bioinformatics 2007).

Users can now also indicate whether they want duplicated protein sequences removed from the results set by checking a box in the "Specify calculation options" section of the input page. Previously redundant results were removed. For users wanting to study different populations, keeping redundant sequences can be very informative.

2.3.3.3 Epitope Cluster Analysis

Version 2.0 of the Epitope Cluster Analysis tool (Dhanda et al., Immunology. 2018) was released in 2018. This new version expanded tool functionality to include graphical representation, to provide connectivity within a cluster, to generate epitope clusters based on representative or consensus sequences, and to calculate overhang sequence identity. The base functionality of the tool remained the same.

The tool groups epitopes into clusters based on sequence identity. A cluster is defined as a group of sequences that has a sequence similarity greater than the minimum sequence identity threshold specified. Epitope sequences can be either directly entered in the text area or uploaded from a file. Two acceptable sequence formats are PLAIN and FASTA. The user can select the sequence identity threshold at which they want to calculate epitope clusters. Clusters are displayed in a table format where clusters are indicated by table rows which have the same color.

2.3.3.4 Computational Methods for Mapping Mimotopes to Protein Antigens

A web page devised by Dr. Julia Ponomarenko was added to the Analysis Tools section in 2014 that provides guidelines for mapping mimotopes to protein antigens. Mimotopes are molecules, often peptides, which are recognized by antibodies or T cells that were primed to recognize a different epitope. For antibody epitope mapping, peptide mimotopes can be selected from a combinatorial library (usually peptides from a specific protein antigen) on binding to a specific monoclonal antibody with high affinity. They are commonly obtained using phage display. Experimental data on mimotopes can be found in the IEDB, MimoDB (http://immunet.cn/mimodb/index.html), and journal publications. Mimotopes can mimic essential features of genuine epitopes and therefore their mapping to the antigen is a logical and essential step of the mimotope analysis. This web page provides information on available methods for mimotope mapping, how to search the IEDB for mimotopes, and an example of a mimotope dataset and the results of its mapping, using the available web servers hosted outside the IEDB.

Methods available as web servers and operational as of July 2014 (they all require the user submitting an antigen protein 3D structure, providing either PDB ID of the structure or the pdb file) are as follows:

- **MIMOX** (http://immunet.cn/mimox/)
- **Pepitope server** (http://pepitope.tau.ac.il/) provides three algorithms: Mapitope, PepSurf, or combined
- **EpiSearch** (http://curie.utmb.edu/episearch.html)

The web page also lists other published methods that are unavailable as web servers. They include the following:

- **PepMapper** (http://www.ncbi.nlm.nih.gov/pubmed/22701536) (2012) - provided URL didn't respond
- **MimoPro** (http://www.ncbi.nlm.nih.gov/pubmed/21609501) (2011) - provided URL didn't respond
- **Pep-3D-Search** (http://www.ncbi.nlm.nih.gov/pubmed/19087303) (2008) - available for download at http://kyc.nenu.edu.cn/Pep3DSearch/
- **MEPS** (http://www.ncbi.nlm.nih.gov/pubmed/17430573) (2007)
- **MIMOP** (http://www.ncbi.nlm.nih.gov/pubmed/16434442) (2006)
- **3D-Epitope-Explorer (3DEX)** (http://www.ncbi.nlm.nih.gov/pubmed/15834923) (2005) - available for download at http://www.schreiber-abc.com/3dex/
- **Enshell-Seijffers et al.** (http://www.ncbi.nlm.nih.gov/pubmed/14596802) (2003)
- **FINDMAP** (http://www.ncbi.nlm.nih.gov/pubmed/12935344) (2003)
- **SiteLight** (http://www.ncbi.nlm.nih.gov/pubmed/12824481) (2003)

The webpage also contains instructions on how to search for mimotopes in the IEDB.

2.3.3.5 Restrictor Analysis Tool for Epitopes (RATE)

RATE is an automated method that can infer HLA restriction for a set of given epitopes from large datasets of T cell responses in HLA typed subjects. The tool takes two data files, one containing the alleles expressed by the subjects and the other containing the response of the peptides in the subjects. The tool calculates the odds ratio and estimates its significance using Fisher's exact test. It also calculates a parameter called relative frequency similar to odds ratio. The tool was developed with a focus on class II alleles but can also be applied to class I alleles. A description of the tool can be found in Paul et al. (Journal of Immunology, 2015).

In 2017, RATE was validated using experimentally defined restriction data from a set of 191 tuberculosis-derived epitopes and 63 healthy individuals with MTB infection from the Western Cape Region of South Africa. Additionally, the parameters used by the RATE tool to infer restriction were optimized. New HLA restrictions were identified using the optimized RATE tool. A description of this study can be found in Paul et al. (BMC Immunol, 2017).

2.3.3.6 ImmunomeBrowser

This tool aggregates all data relevant to the user query and allows one to visualize the known immune response to a specific antigen, as well as illustrating knowledge gaps in a reference protein. It provides the immune reactivity in terms of response frequency (RF) and the number of subjects tested/responded and/or number of independent assays performed along the length of reference protein. The tool was originally implemented in the results page of the database section of the IEDB. To further extend the usability to predicted epitopes and propriety epitopes or non-IEDB data, a stand-alone version of the tool was developed in 2018 (Dhanda et. al., Bioinformatics 2018). The standalone version maps user provided peptide sets and associated response data to a user-provided protein reference sequence. This now allows the user to analyze and visualize immunodominant regions within their own dataset. The results are presented both as a user interactive javascript based web interface and a tabular format in a selected reference sequence.

2.3.4 IEDB Analysis Resource Labs

The AR Labs concept was introduced in early 2016. Tools designated as within AR Labs are experimental and are considered to be beta versions, not quite ready for production yet. They are intended for further research, updates and testing. This means they are functional, but the team is still actively developing on improving them and more substantial changes are expected in upcoming releases. Therefore users are asked not to expect the same level of stability for these tools as for other tools in the IEDB analysis resource. Users are welcome to send bug reports and suggestions for improvements for these tools via the help desk.

Of the tools described above, 7 tools are currently available under the Labs designation:

Prediction LABS Tools

TepiTool
MHCII-NP
Deimmunization
CD4 T Cell Immunogenicity
LYRA

Analysis LABS Tools

RATE
ImmunomeBrowser

2.3.5 Benchmark references and data sets

The “Datasets” tab contains data sets and references related to benchmarking results of the IEDB’s epitope prediction tools. There are three accordion sliders that can be expanded to reveal details. The three are for MHC class I binding prediction, MHC class II binding prediction, and B cell epitope prediction. In each case, the journal article title, authors, journal name, and year are listed along with a description of the data set, the date of its generation, details on the data set generation, the data format, and where the data set is available.

For the MHC class I binding predictions, the references are:

- Trolle T, Metushi IG, Greenbaum JA, Kim Y, Sidney J, Lund O, Sette A, Peters B, Nielsen M. Automated benchmarking of peptide-MHC class I binding predictions. Bioinformatics. 2015 Jul 1;31(13):2174-81. doi: 10.1093/bioinformatics/btv123. Epub 2015 Feb 25. PubMed PMID: 25717196; PubMed Central PMCID: PMC4481849
- Kim Y, Sidney J, Buus S, Sette A, Nielsen M, Peters B. Dataset size and composition impact the reliability of performance benchmarks for peptide-MHC binding predictions. BMC Bioinformatics. 2014 Jul 14;15:241. doi: 10.1186/1471-2105-15-241. PubMed PMID: 25017736; PubMed Central PMCID: PMC4111843
- Kim Y, Sidney J, Pinilla C, Sette A, Peters B. Derivation of an amino acid similarity matrix for peptide: MHC binding and its application as a Bayesian prior. BMC Bioinformatics. 2009 Nov 30;10:394. PubMed PMID: 19948066.
- Peters B, Bui HH, Frankild S, Nielson M, Lundegaard C, Kostem E, Basch D, Lamberth K, Harndahl M, Fleri W, Wilson SS, Sidney J, Lund O, Buus S, Sette A., A community resource benchmarking predictions of peptide binding to MHC-I molecules, PLoS Comput Biol. 2006 Jun 9;2(6):e65. Epub 2006 Jun 9. PMID: 16789818

For the MHC class II binding predictions, the references are:

- Andreatta M, Trolle T, Yan Z, Greenbaum JA, Peters B, Nielsen M. An automated benchmarking platform for MHC class II binding prediction methods. Bioinformatics. 2018 May 1;34(9):1522-1528. doi: 10.1093/bioinformatics/btx820. PMID: 29281002; PMCID: PMC5925780.
- Wang P, Sidney J, Kim Y, Sette A, Lund O, Nielsen M, Peters B. Peptide binding predictions for HLA DR, DP and DQ molecules. BMC Bioinformatics. 2010 Nov 22;11:568. PubMed PMID: 21092157; PubMed Central PMCID: PMC2998531.
- Wang, P., J. Sidney, C. Dow, B. Mothe, A. Sette, B. Peters. (2008). "A Systematic Assessment of MHC Class II Peptide Binding Predictions and Evaluation of a Consensus Approach." PLoS Computational Biology 4(4). PMID: 18389056

For the B cell predictions, the references are:

- Kringelum JV, Nielsen M, Padkjær SB, Lund O. Structural analysis of B-cell epitopes in antibody:protein complexes. Mol Immunol. 2013 Jan;53(1-2):24-34. doi: 10.1016/j.molimm.2012.06.001. Epub 2012 Jul 10. PubMed PMID: 22784991; PubMed Central PMCID: PMC3461403
- Kringelum JV, Lundegaard C, Lund O, Nielsen M. Reliable B cell epitope predictions: impacts of method development and improved benchmarking. PLoS Comput Biol. 2012;8(12):e1002829. doi: 10.1371/journal.pcbi.1002829. Epub 2012 Dec 27. PubMed PMID: 23300419; PubMed Central PMCID: PMC3531324.

- Rubinstein ND, Mayrose I, Martz E, Pupko T. Epitopia: a web-server for predicting B-cell epitopes. BMC Bioinformatics. 2009 Sep 14;10:287. doi: 10.1186/1471-2105-10-287. PubMed PMID: 19751513; PubMed Central PMCID: PMC2751785.
- Liang S, Zheng D, Standley DM, Yao B, Zacharias M, Zhang C. EPSVR and EPMeta: prediction of antigenic epitopes using support vector regression and multiple server results. BMC Bioinformatics. 2010 Jul 16;11:381. doi: 10.1186/1471-2105-11-381. PubMed PMID: 20637083; PubMed Central PMCID: PMC2910724.
- Ponomarenko JV, Bourne PE., Antibody-protein interactions: benchmark datasets and prediction tools evaluation. BMC Struct Biol. 2007 Oct 2;7(1):64. PMID: 17910770

2.3.6 Other Ways to Access Tools

There are several ways that users can access many of the tools in the Analysis Resource in addition to using the tools directly on the Analysis Resource website. On the Analysis Resource home page (http://tools.iedb.org), there are tabs for Tools-API and Download. The former takes the user to information about the RESTful interface. The RESTful (Representational State Transfer) web service is available for the MHC class I and II binding predictions, MHC class I processing predictions, and MHC-NP for T cell epitopes, and linear epitope prediction methods for B cells. The service sends POST request to the tools server, and relies on user supplied parameters. The Tools-API web page contains examples for accessing the service using the 'curl' program, although any program that sends POST requests to the server will work just as well (including a web browser). This feature allows users to perform predictions on the IEDB server in batch mode without having to install any software on their own systems. Additionally, users will always be assured that they are using the latest version of the tools.

The Download tab takes the user to the IEDB Tools Download web page. For users from non-commercial organizations with batch processing needs, the MHC class I and II binding prediction tools, linear B cell epitope prediction tool, ElliPro, the epitope cluster analysis tool, the MHC class I immunogencity tool, and proteasomal cleavage prediction tool (added in 2016) are available as standalone scripts for download. These command line tools are kept in sync with the web tools and should therefore produce the same results as clicking through the web interface. They are freely available to non-profit/academic users through an open source license.

For commercial users that would like to run the analysis resource locally, licenses for a virtual machine image file or standalone downloads are available upon request for a modest annual fee. For the virtual machine, all tools are included except MHC-NP which was not developed by the IEDB team. The virtual machine image is kept in sync with the current version of the IEDB Analysis Resource and is updated approximately every six months. Commercial licenses are also available. Requests for either license can be sent to license@iedb.org.

2.4 Help Overview

The Help pull-down menu contains items that aid the user to understand and utilize the features of the website. Users can access relevant documentation, request help, and provide feedback.

2.4.1 Support

The IEDB Solutions Center is the primary resource for information on using the website's features. The user can submit help requests, check on the status of requests, browse and search the knowledge base and forums, and link to help documentation, such as the Curation Manual. In order to submit a help request via the Solutions Center, users must provide an email address, a subject line, and a description of the issue password. The Solutions Center can also be accessed by a link at the bottom of each web page.

The Solutions Center has extensive documentation organized in forums that address a variety of topics, including the epitope analysis and prediction tools, submitting data to the IEDB, querying the database, and general announcements and updates. The Solutions Center is also the repository for the Annual Compendia, the list of papers published by the IEDB team, release notes for the main website and the Analysis Resource, and the News and Noteworthy forum. In addition, written and video tutorials, including the presentations from the annual IEDB User Workshops can be found there.

2.4.2 Help Request

Users can submit help requests in two ways. At the bottom of most pages is a "Help request" link. This will initiate a submission to the IEDB Solutions Center. The second method also utilizes the IEDB Solutions Center. The top menu bar on the IEDB Solutions Center web page has a "Help Request" link. Selecting this link brings the user to a "Submit a request" web page. The user must fill in their email address, the subject line, and a description of the help request. All help requests are forwarded to the same help desk.

Help requests should consist of problems that users have with the application, such as a certain function of the system not working. Questions on how to use features of the application should be covered in the online help available in the Solutions Center. After submitting a help request, a confirmation e-mail will be sent to the user's e-mail address, which will include the help request number. When the help request issue has been resolved, an e-mail will be sent to notify the user that the help request has been satisfied.

Help requests are generally responded to within one business day and solved within five business days. Requests that are actually bug reports by users are answered initially to inform the requestor that their issue is being forwarded to the appropriate developers and they will be notified when a fix is released. Requests involving the curation or re-curation of articles will typically take longer to resolve.

2.4.3 Provide Feedback

All users are able to submit feedback, which will transmit an email message to the IEDB team. Feedback is intended for questions, input, and suggestions, such as new features they would like to see added in the future. Feedback helps the IEDB team update the system to provide users with the best possible experience. If users need help using the system or handling an unexpected result, a Help Request is more appropriate. The feedback feature can be accessed with the Support pull-down menu and the "Provide Feedback" at the bottom of each web page. Both initiate a submission to the IEDB Solutions Center.

2.4.4 Video Tutorials

There is a link to the IEDB video tutorials under the Help menu at the top of each web page. This link takes the user to the "How-to Videos" article in the Solutions Center in the Tutorials and Reference Materials folder. Most of the videos are edited versions of live presentations made at the annual IEDB User Workshops. The videos from the 2018 event which are currently posted for user viewing are listed in Table

2.1. An overview of the resource and information regarding the data structure and curation are presented first. The next category addresses the query and reporting features. Videos for all the tools in the Analysis Resource are listed next. Videos for the legacy website have been removed because the legacy site has been retired and can no longer be accessed by users.

2.5 More IEDB

The "More IEDB" pull-down menu contains links to other relevant information that may be of interest to users. Its component links are described below.

2.5.1 Database Export

The contents of the Immune Epitope Database are exported weekly to files in XML format. The database export page (Figure 2.35) contains a complete database export in XML format along with exports of the various records that are referenced in the complete database export. The complete dataset export is provided as a ZIP archive (iedb_export.zip) containing one XML file for each reference contained in the database. The export also contains ZIP archives of XML files that provide users with the full record for the various identifiers that are referenced in the full database export, such as the IEDB source organism accession identifier list, the MHC allele name list, and the organism list. The supporting XML files only contain full records when the record is not otherwise available from the original source.

The database export page also provides the relevant XML Schema Definition (XSD) files for each of the XML files provided. The XSD file(s) for a particular XML file are located in the IEDB Schema box in the export table. In the case of the complete database export, multiple schemas are provided, with the primary schema being listed first, followed by any supporting schemas.

In addition to the XML export, the contents of the IEDB are exported weekly as a MySQL Structure Query Language (SQL) database. The database export page contains the complete database export in two formats, a single SQL script (iedb_public.sql.gz), and a TAR archive of MyISAM binary tables (iedb_public.tar.gz). Both export formats are generated from a 5.5.52-MariaDB database server. The database export page also provides an entity-relationship diagram (ERD) for the MySQL database.

Archives of the data as they appeared in IEDB 1.0, 2.0, 2.1, and 2.3 are available by clicking on the *Archived Versions*. For each version, there is a compressed file that contains an XML for each reference. The corresponding XSD files are also available for download.

Select compilations of data are available for download from the Database Export web page in CSV format in the section titled CSV Metric Exports. Users can download these files to conveniently obtain all the information in the IEDB for specific categories. Files are available for all epitopes, antigens, T cell assays, B cell assays, MHC ligand assays, and references. In addition, an export for antibody and T cell receptors was added in 2016. In addition to the files available on the Database Export web page, comma separated values (CSV) file exports are available on-demand from all list pages and list tabs throughout the site.

2.5.2 Meta-Analyses

The IEDB team has conducted a variety of analyses that examine data in the IEDB for several disease conditions and have been published in scientific journals. Over 20 papers have been published covering topics ranging from allergies, diabetes, and multiple sclerosis, to influenza, tuberculosis, malaria. When a user selects this menu item, they are directed to the Meta-analyses folder in the Knowledgebase and Forums section of the IEDB Solutions Center. The forum is updated as new meta-analyses are published. Users who subscribe to the folder will be automatically informed when content is added.

2.5.3 Citing the IEDB

Data and tools within the IEDB are presented as a public resource. Users are requested to consider citing the IEDB when they present information obtained from the IEDB or use tools contained in the Analysis Resource. It is expected that the authors of an entry as well as the IEDB are properly cited whenever their work is referred to:

1. The IEDB website should be cited using the URL: http://www.iedb.org

2. The journal reference for the IEDB was updated in 2018; and should be cited as:

   Vita R, Mahajan S, Overton JA, Dhanda SK, Martini S, Cantrell JR, Wheeler DK, Sette A, Peters B. The Immune Epitope Database (IEDB): 2018 update. Nucleic Acids Res. 2018 Oct 24. doi: 10.1093/nar/gky1006. [Epub ahead of print] PubMed PMID: 30357391.

2.5.4 Release Notes

Release notes are provided whenever a new release of the main website or the Analysis Resource is deployed to the public. When a user selects this menu item, they are directed to the Release Notes folder in the Knowledgebase and Forums section of the IEDB Solutions Center. The forum is updated as new releases are deployed. Users who subscribe to the folder will be automatically informed when content is added.

2.5.5 Links to External Sources

The IEDB system provides a list of links to external resources solely for the convenience of Immune Epitope Database visitors. The Immune Epitope Database has no interest in, responsibility for, or control over the linked-site. The Immune Epitope Database makes no promises or warranties of any kind, express or implied, including those of fitness for any particular purpose, as to the content of the linked-site. To view the links available, select the Links menu item. The hyperlinks on the links page are grouped by category:

- Public Databases, Prediction Algorithms, and Other Tools
- Antibody Related Links
- Bioinformatics Resource Centers
- MHC and TCR Related Links
- Protein Related Links
- Laboratory Resources
- Biodefense Resources

2.6 Learn More

The Learn More web page can be accessed from the link at the bottom of the Welcome box in the upper left-hand corner of the IEDB home page. The Learn More page has five major sections, as seen in Figure 2.36. The upper left section has a carousel of content from the New and Noteworthy forum in the Solutions Center. A graphic is usually included in the forum article that is displayed in the left-hand portion of the section. Below this section are three other sections titled Support, About the Data, and About Us. The Support section has links to submit a help request or feedback. The right-hand panel of the page lists the release notes for the most recent versions of the main website and the Analysis Resource.

The 2019 IEDB user workshop will be held 7-8 November 2019 at NIAID in Rockville, MD, USA. Information is available at workshop.iedb.org.

Ask a question or submit an idea
Browse support topics
Watch how to videos
Get help with common searches
Browse links to epitope resources

Export all or part of the IEDB
Meta-analyses
Read about the data fields
See how the data is entered
Learn about the IEDB ontology

Citation guidelines
IEDB publications
Acknowledgments
Terms of use
Annual Compendia

IEDB Analysis Resource v2.21 release not
(26 Mar 2019)

- NEW: SCEptRe - Structural Complexe of Epitope Receptor
- Improved sequence format detection added to MHC I binding, MHC II bindin D...

IEDB v3.10.0 release notes
IEDB v3.10.0 release notes
This topic contains the release notes for IED version 3.10.0.

- Redesigned receptor database tables a...

IEDB v3.10.0 release notes
IEDB v3.10.0 release notes
This topic contains the release notes for IED version 3.10.0.

- Redesigned receptor database tables a...

IEDB v3.10.0 release notes
IEDB v3.10.0 release notes

This topic contains the release notes for IED version 3.10.0.

- Redesigned receptor...

View Previous Release Notes >>

Figure 2.35 The Learn More page, accessed from the Welcome message in the upper left corner of the IEDB home page

2.6.1 Support

Each link is briefly described below.

Ask a question or submit an idea

This link allows the user to submit a help request or suggestion via the IEDB Solutions Center. The user must specify their email address, the subject of their request, and description of the problem or suggestion. Users can also attach relevant files.

Browse support topics

The IEDB Solutions Center home page has a variety of user help, including several resources for getting started with the IEDB, recent Release Notes, and timely articles.

Watch how to videos

Videos describing the use of the main website and the Analysis Resource are located in the Solutions Center at http://help.iedb.org/entries/140865-How-To-Videos. See Section 2.4.4 for further details.

Get help with common searches

There is a category in the Solutions Center that contains a list of common queries and questions. These queries have been designed to parallel the IEDB meta-analysis efforts. Meta-analyses are performed at intervals to query the database for all data relating to subjects of interest (ex. Influenza, Malaria, Tuberculosis). These queries represent a simplified version of such analysis.

Browse links to epitope resources

The IEDB system provides a list of links to external resources solely for the convenience of Immune Epitope Database visitors as described in Section 2.5.5.

2.6.2 About the Data

Each link is briefly described below.

Export all or part of the IEDB

Clicking on this link will bring the user to the Database Export page that is described in Section 2.5.1.

Meta-analyses

The meta-analyses conducted by the IEDB team are described in Section 2.5.2.

Read about the data fields

This link gives the user access to a subset of the Curation Manual hosted in a Wiki that describes and defines the various data fields. Using the Find function of their web browser, users can search for the data field name of interest in order to gain a fuller understanding of the field definition and the possible values.

See how the data is entered

Users can access the full IEDB Curation Manual. The rules for curating all data fields are described in this Wiki.

Learn about the IEDB ontology

Selecting IEDB Ontology takes the user to http://ontology.iedb.org, the home page for the Ontology of Immune Epitopes (ONTIE). The IEDB ontology is available to download in a format that can be viewed with the Protégé OWL editor. The file ONTIE.owl contains the classes and relations used in the IEDB export. IEDB-export.owl is the ONTIE-annotated export of the IEDB T cell epitope data. Smaller versions of the file are available for download. The ONTIE home page also lists related ontologies that are used in constructing ONTIE.

2.6.3 About Us

Citation Guidelines

This link brings the user to the "Citing the IEDB" web page described in Section 2.5.3.

IEDB Publications

A list of publications relevant to the IEDB can be found on the Publications page. They have been grouped into four categories – General IEDB, Epitope Meta-analyses, Analysis Resource, and Curation. This list is updated with each new release of the main website. A list of IEDB related publications can also be found in the Publications folder in the IEDB Solutions Center.

Acknowledgements

A host of talented individuals have worked hard to make the Immune Epitope Database a reality. A roster of the current team members can be viewed on this page.

Terms of Use

The Terms of Use page is a collection of statements that outline the conditions related to using the IEDB system. The Terms of use includes our privacy notice, copyright information, and various disclaimers. The IEDB privacy policy describes what user information is collected, the circumstances for collecting it, and how it is used. Personal information about users is not collected unless the users choose to provide it.

Annual Compendia

An archive of the IEDB Annual Compendia can be found at this link to the IEDB Solutions Center. The list includes all Annual Compendia going back to 2005. The section also includes the IEDB System and Architecture Design document.

3 Scientific Publications

This section lists the scientific publications for which the IEDB played a contributory role. The first section lists publications authored by the IEDB contractor team over the past 16 years. The second section lists references that cited the IEDB. This list was compiled by using Google Scholar and the ISI Web of Knowledge to find citations for each one of the IEDB team authored papers.

3.1 IEDB Sponsored Publications

Scientific articles written by the IEDB team members that are relevant to the IEDB are listed below (organized by year of publication) through 2018. This publication list was re-evaluated in December 2018 to ensure that the list was accurate and up to date. Five publications were removed and deemed non-IEDB related. Additionally, twenty-five publications that were written by the IEDB team were added after noticing that they had been overlooked in early contract years. In many cases these were also difficult to link on PubMed as well since there were typos in the contract number. As a result of this review, the publication list now contains 148 IEDB sponsored publications between program inception in 2003 and 31 December 2018.

Year	Type	Paper	PMID	Journal
2018	General	Investigation of outbreak-specific nonsynonymous mutations on Ebolavirus GP in the context of known immune reactivity	30581874	Journal of Immunology Research
		FAIR principles and the IEDB: Short-term improvements and a Long-term vision of OBO-Foundry mediated machine-actionable interoperability	29688354	Database
		A Review on T Cell Epitopes Identified Using Prediction and Cell-Mediated Immune Models for Mycobacterium tuberculosis and Bordetella pertussis	30555469	Frontiers in Immunology
		Identification of Errors in the IEDB Using Ontologies	29688357	Database
		Epitope Specific Antibodies and T Cell Receptors in the Immune Epitope Database	30515166	Frontiers in Immunology
		The Immune Epitope Database (IEDB): 2018 update	30357391	Nucleic Acids Research
	Tools	An automated benchmarking platform for MHC class II binding prediction methods	29281002	Bioinformatics
		Bioinformatics Tools for the Prediction of T-Cell Epitopes.	29714025	Methods Mol Biol
		Development of a novel clustering tool for linear peptide sequences	30014462	Immunology
		Predicting HLA CD4 immunogenicity in human populations	29963059	Frontiers in Immunology
		Footprints of antigen processing boost MHC class II natural ligand binding predictions	30446001	Genome Medicine
		Computational Tools for the Identification and Interpretation of Sequence Motifs in Immunopeptidomes	29327813	Proteomics
		ImmunomeBrowser: A tool to aggregate and visualize complex and heterogeneous epitopes in reference protein	29878047	Bioinformatics
		Improved methods for predicting peptide binding affinity to MHC class II molecules	29315598	Immunology
		Determination of a Predictive Cleavage Motif for Eluted Major Histocompatibility Complex Class II Ligands	30127785	Frontiers in Immunology

		Microbiota epitope similarity either dampens or enhances the immunogenicity of disease-associated antigenic epitopes	29734356	PLoS One
2017	General	Deciphering the MHC-associated peptidome: a review of naturally processed ligand data	28756714	Expert Rev Proteomics
		Unconventional peptide Presentation by Major Histocompatibility Complex (MHC) Class I Allele HLA-A*02:01: Breaking Confinement	28179428	J Biol Chem
		The Immune Epitope Database: How Data Are Entered and Retrieved	28634590	J Immunol Res
		Better living through ontologies at the Immune Epitope Database	28365732	Database (Oxford)
		The SysteMHC Atlas project	28985418	Nucleic Acids Res
		The Immune Epitope Database and Analysis Resource in Epitope Discovery and Synthetic Vaccine Design	28352270	Front Immunol
	Tools	Experimental validation of the RATE tool for inferring HLA restrictions of T cell epitopes	28681704	BMC Immunology
		Citrullination only infrequently impacts peptide binding to HLA class II MHC	28481943	PLoS One
		Machine learning reveals a non-canonical mode of peptide binding to MHC class II molecules	28542831	Immunology
		NNAlign: a platform to construct and evaluate artificial neural network models of receptor-ligand interactions	28407117	Nucleic Acids Res
		BepiPred-2.0: improving sequence-based B-cell epitope predictions using conformational epitopes	28472356	Nucleic Acids Res
		GibbsCluster: unsupervised clustering and alignment of peptide sequences	28407089	Nucleic Acids Res
		An introduction to Deep learning on biological sequence data - Examples and solutions	28961695	Bioinformatics
		Development of a strategy and computational application to select candidate protein analouges with reduced HLA binding and immunogenicity	28833085	Immunology
		NetMHCpan 4.0: Improved peptide-MHC class I interaction predictions integrating eluted ligand and peptide binding affinity data	28978689	J Immunol
2016	General	Ebola: an analysis of immunity at the molecular level		IEEE Xplore Digital Library
		Identifying candidate targets of immune responses in Zika virus based on homology to epitopes in other Flavivirus species	28018746	PLoS Curr
		Immune Epitope Database and Analysis Resource (IEDB)		Encylopedia of Bioimmunology
		An Ontology for Major Histocompatibility Restriction	26759709	J Biomed Semantics
		The Ontology for Biomedical Investigations	27128319	PLoS One
		Reproducibility and Conflicts in Immune Epitope Data	26678806	Immunology
	Tools	The Length Distribution of Class I-Restricted T Cell Epitopes Is Determined by Both Peptide Supply and MHC Allele-Specific Binding Preference	26783342	J Immunol

		NetMHCpan-3.0; improved prediction of binding to MHC class I molecules integrating information from multiple receptor and peptide length data sets	27029192	Genome Med
		T-cell recognition is shaped by epitope sequence conservation in the host proteome and microbiome	26789414	Immunology
		TepiTool: A pipeline for computational prediction of T cell epitope candidates	27479659	Current Protocols in Immunology
		Toxoplasma gondii peptide ligands open the gate of the HLA class I binding groove	26824387	Elife
		Gapped sequence alignment using artificial neural networks: application to the MHC class I system	26515819	Bioinformatics
		Pan-Specific Prediction of Peptide-MHC Class I Complex Stability, a Correlate of T Cell Immunogenicity	27402703	J Immunol
2015	General	Analysis of Human RSV immunity at the molecular level: learning from the past and present	26001197	PLoS One
		The Use of the Immune Epitope Database (IEDB) to Study Autoimmune Epitope Data related to Alopecia Areata	26551944	Journal of Investigative Dermatology
		The immune epitope database (IEDB) 3.0	25300482	Nucleic Acids Res
		Consequences of periodic α-to-β(3) residue replacement for immunological recognition of peptide epitopes	25559929	ACS Chem Biol
	Tools	Automated benchmarking of peptide-MHC class I binding predictions	25717196	Bioinformatics
		Development and validation of a broad scheme for prediction of HLA class II restricted T cell epitopes	25862607	J Immunol Methods
		Automatic generation of validated specific epitope sets	26568965	J Immunol Res
		Antibody specific epitope prediction - emergence of a new paradigm	25837466	Curr Opin Virol
		A population response analysis approach to assign class II HLA-epitope restrictions	25948811	J Immunol
		LYRA, a webserver for lymphocyte receptor structural modeling	26007650	Nucleic Acids Res
		Accurate pan-specific prediction of peptide-MHC class II binding affinity with improved binding core identification	26416257	Immunogenetics
2014	General	Substantial gaps in knowledge of Bordetella pertussis antibody and T cell epitopes relevant for natural immunity and vaccine efficacy	24530743	Human Immunology
		Conservancy of mAb epitopes in Ebolavirus glycoproteins of previous and 2014 outbreaks	25642381	PLoS Curr
		A molecular view of multiple sclerosis and experimental autoimmune encephalitis: What can we learn from the epitope data?	24365494	J Neuroimmunol
	Tools	Dataset size and composition impact the reliability of performance benchmarks for peptide-MHC binding predictions	25017736	BMC Bioinformatics
		NetTepi: an integrated method for the prediction of T-cell epitopes	24863339	Immunogenetics

		NetMHCstab - predicting stability of peptide:MHC-I complexes; impacts for CTL epitope discovery	23927693	Immunology
		Characterization of binding specificities of bovine leucocyte class I molecules: impacts for rational epitope discovery	25186069	Immunogenetics
2013	General	Navigating diabetes-related immune epitope data: resources and tools provided by the Immune Epitope Database (IEDB)	25140192	Immunome Res
		Query Enhancement through the Practical Application of Ontology: The IEDB and OBI	23734660	J Biomed Semantics
		Positional Bias of MHC Class I Restricted T-Cell Epitopes in Viral Antigens is likely due to a Bias in Conservation	23357871	PLoS Comput Biol
	Tools	Evaluating the immunogenicity of protein drugs by applying in vitro MHC binding data and the immune epitope database and analysis resource	24222776	Clin Dev Immunol
		Properties of MHC class I presented peptides that enhance immunogenicity	24204222	PLoS Comp Biol
		NetMHCIIpan-3.0, a common pan-specific MHC class II prediction method including all three human MHC class II isotypes, HLA-DR, HLA-DP and HLA-DQ	23900783	Immunogenetics
		SigniSite: Identification of residue-level genotype-phenotype correlations in protein multiple sequence alignments	23761454	Nucleic Acids Res
		Evaluation of peptide selection approaches for epitope-based vaccine design	24461003	Tissue Antigens
		HLA Class I Alleles Are Associated with Peptide-Binding Repertoires of Different Size, Affinity, and Immunogenicity	24190657	J Immunol
		Structural analysis of B-cell epitopes in antibody:protein complexes	22784991	Mol Immunol
2012	General	A meta-analysis of the existing knowledge of immunoreactivity against hepatitis C virus (HCV)	22675428	PLoS One
		The immune epitope database: a historical retrospective of the first decade	22681406	Immunology
		Strategies to query and display allergy-derived epitope data from the Immune Epitope Database (IEDB)	23172234	Int Arch Allergy Immunol
		A Comparison of Epitope Repertoires Associated with Myasthenia Gravis in Humans and Nonhuman Hosts	23243503	Autoimmune Dis
	Tools	Immune epitope database analysis resource	22610854	Nucleic Acids Res
		Predictions versus high-throughput experiments in T-cell epitope discovery: competition or synergy?	22149708	Expert Rev Vaccines
		NetMHCcons: a consensus method for the major histocompatibility complex class I predictions.	22009319	Immunogenetics
2011	General	Cost sensitive hierarchical document classification to triage PubMed abstracts for manual curation	22182279	BMC Bioinformatics
		A Model for Collaborative Curation, The IEDB and ChEBI Curation of Non-peptidic Epitopes	21897450	Immunome Res
		IEDB-3D: structural data within the immune epitope database	21030437	Nucleic Acids Res

	Tools	Applications for T-cell epitope queries and tools in the Immune Epitope Database and Analysis Resource	21047510	J Immunol Methods
		Prediction of epitopes using neural network based methods	21047511	J Immunol Methods
		A computational pipeline to generate MHC binding motifs	28747991	Immunome Res
2010	General	Towards defining molecular determinants recognized by adaptive immunity in allergic disease: an inventory of the available data	21403821	J Allergy (Cairo)
		OBI consortium. Modeling biomedical experimental processes with OBI	20626927	J Biomed Semantics
		Design and utilization of epitope-based databases and predictive tools	20213141	Immunogenetics
		Meta-analysis of all immune epitope data in the Flavivirus genus: inventory of current immune epitope data status in the context of virus immunity and immunopathology	20565291	Viral Immunol
		The Immune Epitope Database 2.0	19906713	Nucleic Acids Res
		Molecular determinants of T cell epitope recognition to the common Timothy grass allergen	20554959	J Immunol
		Divergent motifs but overlapping binding repertoires of six HLA-DQ molecules frequently expressed in the worldwide human population.	20810981	J Immunol
		Five HLA-DP molecules frequently expressed in the worldwide human population share a common HLA supertypic binding specificity	20139279	J Immunol
		Uncovering the interplay between CD8, CD4 and antibody responses to complex pathogens.	20143946	Future Microbiol
	Tools	MHC class II epitope predictive algorithms	20408898	Immunology
		Peptide binding predictions for HLA DR, DP and DQ molecules	21092157	BMC Bioinformatics
		Limitations of Ab initio predictions of peptide binding to MHC class II molecules	20174654	PLoS One
		NetCTLpan: pan-specific MHC class I pathway epitope predictions	20379710	Immunogenetics
		The MHC motif viewer: a visualization tool for MHC binding motifs.	20143317	Curr Protoc Immunol
2009	General	Classification of the universe of immune epitope literature: representation and knowledge gaps	19774228	PLoS One
		Pre-existing immunity against swine-origin H1N1 influenza viruses in the general human population	19918065	Proc Natl Acad Sci
		Meta-analysis of immune epitope data for all Plasmodia: overview and applications for malarial immunobiology and vaccine-related issues	19149776	Parasite Immunol
		Two MHC class I molecules associated with elite control of immunodeficiency virus replication, Mamu-B*08 and HLA-B*2705, bind peptides with sequence similarity.	19494300	J Immunol
		Diverse recognition of conserved orthopoxvirus CD8+ T cell epitopes in vaccinated rhesus macaques.	19531389	Vaccine

		Definition of epitopes and antigens recognized by vaccinia specific immune responses: their conservation in variola virus sequences, and use as a model system to study complex pathogens	20006135	Vaccine
	Tools	NetMHCpan, a method for MHC class I binding prediction beyond humans	19002680	Immunogenetics
		Derivation of an amino acid similarity matrix for peptide: MHC binding and its application as a Bayesian prior	19948066	BMC Bioinformatics
		The PickPocket method for predicting binding specificities for receptors based on receptor pocket similarities: Application to MHC-peptide binding	19297351	Bioinformatics
		Pan-specific MHC class I predictors: a benchmark of HLA class I pan-specific prediction methods	18996943	Bioinformatics
2008	General	The Curation Guidelines of the Immune Epitope Database and Analysis Resource	18688821	Cytometry A
		Analysis of epitope information related to Bacillus anthracis and Clostridium botulinum	18251694	Expert Rev Vaccines
		Quantitative peptide binding motifs for 19 human and mouse MHC class I molecules derived using positional scanning combinatorial peptide libraries	18221540	Immunome Res
		HLA class I supertypes: a revised and updated classification	18211710	BMC Immunol
		Immunodominant epitopes in herpes simplex virus type 2 glycoprotein D are recognized by CD4 lymphocytes from both HSV-1 and HSV-2 seropositive subjects	18941251	J Immunol
	Tools	NetMHC-3.0: accurate web accessible predictions of human, mouse and monkey MHC class I affinities for peptides of length 8-11	18463140	Nucleic Acids Res
		Quantitative Predictions of Peptide Binding to Any HLA-DR Molecule of Known Sequence: NetMHCIIpan	18604266	PLoS Computational Biology
		B-cell epitope prediction		Structural Bioinformatics
		ElliPro: a new structure-based tool for the prediction of antibody epitopes	19055730	BMC Bioinformatics
		A Systematic Assessment of MHC Class II Peptide Binding Predictions and Evaluation of a Consensus Approach	18389056	PLoS Computational Biology
		Immune epitope database analysis resource (IEDB-AR)	18515843	Nucleic Acids Res
2007	General	An analysis of the epitope knowledge related to Mycobacteria	18081934	Immunome Res
		Ab and T cell epitopes of influenza A virus, knowledge and opportunities	17200302	Proc Natl Acad Sci
		Meeting Report: NIH Workshop on the Tuberculosis Immune Epitope Database	18068490	Tuberculosis (Edinb)
		Integrating epitope data into the emerging web of biomedical knowledge resources	17479127	Nat Rev Immunol
		Immune epitope mapping in the post-genomic era: lessons for vaccine development	17113275	Curr Opin Immunol
		Automating document classification for the Immune Epitope Database	17655769	BMC Bioinformatics

		Characterization of the peptide-binding specificity of the chimpanzee class I alleles A 0301 and A 0401 using a combinatorial peptide library	17701407	Immunogenetics
	Tools	Antibody-protein interactions: benchmark datasets and prediction tools evaluation.	17910770	BMC Struct Biol
		EpitopeViewer: a Java application for the visualization and analysis of immune epitopes in the Immune Epitope Database and Analysis Resource (IEDB)	17313688	Immunome Res
		Development of an epitope conservancy analysis tool to facilitate the design of epitope-based diagnostics and vaccines	17897458	BMC Bioinformatics
		Towards a consensus on datasets and evaluation metrics for developing B-cell epitope prediction tools	17205610	J Mol Recognit
		Modeling the adaptive immune system: predictions and simulations	18045832	Bioinformatics
		NetMHCpan, a method for quantitative predictions of peptide binding to any HLA-A and -B locus protein of known sequence	17726526	PLoS One
2006	General	The biocurator: connecting and enhancing scientific data	17069454	PLoS Comput Biol
		The Immune Epitope Database and Analysis Resource		Conference Procedings
		Curation of complex, context-dependent immunological data	16836764	BMC Bioinformatics
	Tools	Predicting population coverage of T-cell epitope-based diagnostics and vaccines	16545123	BMC Bioinformatics
		A community resource benchmarking predictions of peptide binding to MHC-I molecules	16789818	PLoS Comput Biol
2005	General	The design and implementation of the immune epitope database and analysis resource	15895191	Immunogenetics
		The Immune Epitope Database and Analysis Resource: From Vision to Blueprint	15760272	PLoS Biology
		An ontology for immune epitopes: application to the design of a broad scope database of immune reactivities	16305755	Immunome Res
		A Roadmap for the Immunomics of Category A–C Pathogens	15773067	Immunity
		Characterization of the peptide-binding specificity of Mamu-A*11 results in the identification of SIV-derived epitopes and interspecies cross-reactivity	15747117	Immunogenetics
	Tools	Generating quantitative models describing the sequence specificity of biological processes with the stabilized matrix method	15927070	BMC Bioinformatics
		A computational resource for the prediction of peptide binding to Indian rhesus macaque MHC class I molecules.	16137805	Vaccine
2004	General	The immune epitope database and analysis resource: from vision to blueprint	16312048	Genome Inform
		Identification of seventeen new simian immunodeficiency virus-derived CD8+ T cell epitopes restricted by the high frequency molecule, Mamu-A*02, and potential escape from CTL recognition	15470050	J Immunol

2003	General	In silico prediction of peptides binding to multiple HLA-DR molecules accurately identifies immunodominant epitopes from gp43 of Paracoccidioides brasiliensis frequently recognized in primary peripheral blood mononuclear cell responses from sensitized individuals	15208742	Mol Med

3.2 Publications Citing the IEDB in 2017

In 2018, the IEDB or Analysis Resource received of total of 2,215 citations. This represents an increase of 758 citations over 1,457 from the previous year (2017). The citation list includes 759 references which formally cited one or more of the 148 papers written by the IEDB team over the past sixteen years, and an additional 556 references that cited the IEDB in-text but did not cite a specific reference. Of note, this total may increase over time since these databases may not include references published late in 2018.

The formal citation list was compiled by using Google Scholar and the ISI Web of Knowledge to find citations for each one of the 148 papers and excludes self-citations. In contrast, often scientific reports quote the IEDB not as a formal citation, but by simply stating in the text that the IEDB was used or listing the website address. Here we developed and implemented a plan to address in-text citations (informal mentions of the IEDB, rather than a direct citation). For this purpose we utilized Publish or Perish, a software program that retrieves citations from Crossref, Google Scholar, Microsoft Academic, Scopus, and Web of Science, and returns output that can easily be converted to an excel file. The tool can capture citations that the document specialist's citation analysis, which includes Google Scholar and Web or Science, may have missed, and can capture references that cite the IEDB in text but do not cite a specific IEDB-related publication.

The papers have been categorized by the type of IEDB paper they cited – General IEDB (G) or Analysis Resource (AR). All papers listed below denote their category or categories with these abbreviations since a paper can cite several IEDB papers that belong in different categories. For example, a paper that cites an analysis resource paper may also cite the primary IEDB Nucleic Acids Res (2014) paper, and thus is listed under General IEDB and has an [AR, G] to indicate the Analysis Resource citation. Any paper that has "General" as one of its categories has been listed in the General category below.

3.2.1 References Formally Citating IEDB Publications

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Ref Type: Book Chapter **[G, AR]**

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