

*Secreted Aspartyl Proteinases Targeted Multiepitope Vaccine Design for Candida dubliniensis using Immunoinformatics*

Nahid Akhtar<sup>1</sup>, Jorge Samuel Leon Magdaleno<sup>2</sup>, Suryakant Ranjan<sup>3</sup>, Atif Khurshid Wani<sup>3</sup>, Ravneet Kaur Grewal<sup>1</sup>, Romina Oliva<sup>4</sup>, Abdul Rajjak Shaikh<sup>1,\*</sup>, Luigi Cavallo<sup>2,\*</sup>, Mohit Chawla<sup>2,\*</sup>

<sup>1</sup>Department of Research and Innovation, STEMskills Research and Education Lab Private Limited, Faridabad 121002, Haryana, India, <sup>2</sup>King Abdullah University of Science and Technology (KAUST), Physical Sciences and Engineering Division, Kaust Catalysis Center, Thuwal 23955-6900, Saudi Arabia. <sup>3</sup>School of Bio-Engineering and Bio-Sciences, Lovely Professional University, Punjab, India <sup>4</sup>Department of Sciences and Technologies, University Parthenope of Naples, Centro Direzionale Isola C4, I-80143, Naples, Italy.

Email: mohitchawla.bt@gmail.com; Mohit.chawla@kaust.edu.sa; luigi.cavillo@kaust.edu.sa; ab\_rajjak@yahoo.co.in

Table S1: Protein ids with corresponding predicted T<sub>h</sub> cell epitopes with their corresponding calculated parameters

Protein ID	Allele	Peptide	Binding Affinity (nM)	Vaxijen score	Antigen/Non-antigen	Allergenicity	Toxicity	IL-2 inducers	IL-4 inducer	IFN epitope
XP_002421073.1	DRB1_0101	DNFLRSAYI	458.8	-0.7148	Non-antigen					
		FEVIKTPVN	884.8	0.5796	Antigen	Non-allergen	Non-Toxin	non-inducer		
		FNFANNAKI	1288.5	1.9797	Antigen	Allergen				
	DRB1_0301	LLVDATPAK	1992.1	0.8572	Antigen	Allergen				
		ILGDNFLRS	4556.4	0.3729	Non-antigen					
		PVTSDELRL	5130.2	2.1556	Antigen	Non-Allergen	Non-Toxin	non-inducer		
		VTLDLFEVIK	5558.1	1.7315	Antigen	Non-Allergen	Non-Toxin	non-inducer		

		LVDATPAK R	6639.7	1.2091	Antigen	Allergen				
		ALLVDATP A	7538.3	0.1407	Non- antigen					
		NILGDNFL R	7598.4	0.7548	Antigen	Allergen				
		VTSDRELRI	7896.3	2.8970	Antigen	Non- Allergen	Non-Toxin	non- inducer		
		VFADVTKT S	8033.9	-1.3433	Non- antigen					
		VLLDSGTTI	8439.5	-1.2202	Non- antigen					
		ITLNSIKAA	9810.5	0.3230	Non- antigen					
		VTLNNEVV S	9821.0	0.3759	Non- antigen					
	DRB1_040 1	LYLNSPNA A	1495.4	1.8544	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		YTSASNIA A	1977.6	1.6527	Antigen	Allergen				
		YAADITVG S	2706.6	2.2518	Antigen	Allergen				
		LLLGINDA N	2799.3	0.3488	Non- antigen					
		FALLVDAT P	3262.3	0.6164	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		LYKDTVGF G	3779.0	0.7262	Non- antigen	Allergen				
		LLVDATPA K	4181.5	0.8572	Non- antigen	Allergen				
		YSLYLNSP N	4884.6	2.7280	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		KYTSASNI A	4986.4	1.5271	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	No
		LRITLNSIK	6742.4	0.3099	Non- antigen					
		FIALAFALL	6931.1	-1.2598	Non- antigen					
		ILGDNFLRS	7196.5	0.3729	Non- antigen					
		LKNIFIALA	7603.3	-0.2144	Non- antigen					
	DRB1_070 1	FNFANNA KI	21.7	1.9797	Antigen	Allergen				
		VKYTSASNI	55.5	1.3080	Antigen	Allergen				
		LFYTNGQP Y	155.5	-2.0996	Non- antigen					
	DRB1_080 1	FEVIKTPVN	738.5	0.5796	Antigen	Non- Allergen	Non-Toxin	non- inducer		
	DRB1_090 1	FNFANNA KI	204.4	1.9797	Antigen	Allergen				
		QRLGNPFY I	772.0	1.8625	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		FCKGKGLY T	815.2	0.7052	Antigen	Allergen				
		AKNAYSLY L	1039.3	2.3423	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		ISLAQVKY T	1153.0	0.3063	Non- antigen					
	DRB1_100 1	YSLYLNSP N	387.7	2.7280	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		FIALAFALL	608.1	-1.2598	Non- antigen					

		FEVIKTPVN	739.8	0.5796	Antigen	Non-Allergen	Non-Toxin	non-inducer		
		QRLGNPFYI	1280.9	1.8625	Antigen	Non-Allergen	Non-Toxin	Inducer	Non-inducer	
		FNFANNAKI	1299.3	1.9797	Antigen	Allergen				
		YTSASNIAA	1461.9	1.6527	Antigen	Allergen				
		YFQQDVACQ	1476.4	0.6098	Antigen	Allergen				
	DRB1_1201	EISLAQVKY	457.3	0.8786	Antigen	Non-allergen	Non-Toxin	Inducer	Inducer	Yes
		VIAKNAYSLL	824.4	1.1626	Antigen	Allergen				
		IAKNAYSLLY	1015.5	1.2062	Antigen	Allergen				
	DRB1_1301	ITVGSNRQK	36.6	0.8698	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
	DRB1_1501	KNIFIALAF	4846.0	-0.1472	Non-antigen					
	DRB1_1602	FEVIKTPVN	2987.8	0.5796	Antigen	Non-Allergen	Non-Toxin	non-inducer		
		FCKGKGLYT	4577.0	0.7052	Antigen	Allergen				
		FYIGYGDGS	4867.7	0.3848	Non-antigen					
		YTSASNIAA	4929.0	1.6527	Antigen	Allergen				
		YSLYLNSPN	5127.4	2.7280	Antigen	Non-Allergen	Non-Toxin	Inducer	Non-inducer	
		FIALAFALL	5316.4	-1.2598	Non-antigen	Allergen				
		SLYLNSPNA	5481.5	1.9820	Antigen	Allergen				
XP_002422286.1	DRB1_0101	FSVVKTPKA	231.6	0.2835	Non-antigen					
		DNFLRSAYI	458.8	-0.7148	Non-antigen					
		FVALDFSVV	740.5	-0.0489	Non-antigen					
		ITYLQQDLA	1297.4	0.2152	Non-antigen					
		FNFSKNAKI	1508.6	3.0085	Antigen	Allergen				
	DRB1_0301	LQTDDGQTY	4519.0	2.0692	Antigen	Allergen				
		ILGDNFLRS	4556.4	0.3729	Non-antigen					
		VALDFSVVK	5122.8	1.4652	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	Yes
		VLADISSTS	5845.1	-0.0736	Non-antigen					
		NILGDNFLR	7598.4	0.7548	Antigen	Allergen				
		LLVDATPTT	7860.5	0.4365	Non-antigen					
		VLLDSGTTI	8439.5	-1.2202	Non-antigen					
		QLLFDVND A	9217.7	1.4332	Antigen	Allergen				
		ALLVDATPT	9947.4	-0.1166	Non-antigen					

		INTDNVDV L	10250.5	2.2948	Antigen	Allergen				
	DRB1_040 1	YLVDCNVS G	1337.0	2.0307	Antigen	Allergen				
		LYLNSPNA A	1495.4	1.8544	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		YTSESSISA	1538.5	1.7220	Antigen	Allergen				
		FYLVDCNV S	1750.4	1.9914	Antigen	Allergen				
		YAADITVG S	2706.6	2.2518	Antigen	Allergen				
		LLFDVNDA N	3575.9	1.3427	Antigen	Non- allergen	Non-toxin	Non- inducer		
		LLVDATPT T	3709.0	0.4365	Non- antigen					
		LYKDTVGF G	3779.0	0.7262	Antigen	Allergen				
		YSLYLNSP N	4884.6	2.7280	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		VLADISSTS	4916.3	-0.0736	Non- antigen					
		FSVVKTPK A	6098.9	0.2835	Non- antigen					
		ILGDNFLRS	7196.5	0.3729	Non- antigen					
		FVALDFSV V	7449.0	-0.0489	Non- antigen					
		FIALAIAL	7542.6	-1.6002	Non- antigen					
		LKNIFIALA	7603.3	-0.2144	Non- antigen					
	DRB1_070 1	FNFSKNAK I	7.7	3.0085	Antigen	Allergen				
		FSVVKTPK A	50.3	0.2835	Non- antigen					
	DRB1_080 1	FSVVKTPK A	440.9	0.2835	Non- antigen					
	DRB1_090 1	FNFSKNAK I	283.2	3.0085	Antigen	Allergen				
		FIALAIAL	414.6	-1.6002	Non- antigen					
		LRISLGSVE	635.3	1.0764	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	No
		AKNAYSLY L	1039.3	2.3423	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		ISLAQVKY T	1153.0	0.3063	Non- antigen					
		FSVVKTPK A	1213.6	0.2835	Non- antigen					
		VVKAFNGE L	1220.2	2.9469	Antigen	Non- Allergen	Non-Toxin	non- inducer		
	DRB1_100 1	FIALAIAL	157.6	-1.6002	Non- antigen					
		YSLYLNSP N	387.7	2.7280	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		FVALDFSV V	1122.8	-0.0489	Non- antigen					
		VKAFNGEL T	1504.7	3.7836	Antigen	Non- Allergen	Non-Toxin	non- inducer		
	DRB1_120 1	EISLAQVK Y	457.3	0.8786	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	Yes
		VIAKNAYS L	824.4	0.1626	Antigen	Allergen				

		IAKNAYSL Y	1015.5	1.2062	Antigen	Allergen				
	DRB1_150 1	KNIFIALAI	2714.9	-0.5022	Non- antigen					
	DRB1_160 2	FSVVKTPK A	1515.4	0.2835	Non- antigen					
		FIALAIALL	4376.1	-1.6002	Non- antigen					
		YSLYLNSP N	5127.4	2.7280	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		SLYLNSPN A	5481.5	1.9820	Antigen	Allergen				
XP_00241 9429.1	DRB1_010 1	DNFLRSAY I	458.8	-0.7148	Non- antigen					
		FVALNFDV I	1590.6	0.4788	Non- antigen					
	DRB1_030 1	ILGDNFLRS	4556.4	0.3729	Non- antigen					
		NILGDNFL R	7598.4	0.7548	Antigen	Allergen				
		FAFDKNAK I	8253.1	2.8615	Antigen	Allergen				
		VLLDSGTTI	8439.5	-1.2202	Non- antigen					
		TLLNEQVS Y	9748.3	-1.5464	Non- antigen					
	DRB1_040 1	FYLVCNLS	868.4	1.9516	Antigen	Allergen				
		YLVCNLS G	1204.3	2.0007	Antigen	Allergen				
		YASDITVGS	1814.8	2.2550	Antigen	Allergen				
		YTTASNIA A	2350.3	1.5991	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		WYKDTIGF G	3835.1	0.3524	Non- antigen					
		KYTTASNI A	4884.4	1.5933	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	No
		IKTHKNVT G	4937.6	3.0294	Antigen	Non- Allergen	Non-Toxin	non- inducer		
		LLNEQVSY A	5820.9	-0.7659	Non- antigen					
		LITLPTTSN	5966.1	0.3321	Non- antigen					
		FADVTSST V	6294.5	-0.0970	Non- antigen					
		LKNIFITLA	6396.3	-0.3461	Non- antigen					
		ILGDNFLRS	7196.5	0.3729	Non- antigen					
		LLVDAIPTT	7278.3	-0.2254	Non- antigen					
		VIKTHKNV T	7327.9	0.5833	Non- antigen	Non- allergen	Non-toxin	Non- inducer		
	DRB1_070 1	VKYTTASN I	25.6	1.3190	Antigen	Allergen				
		CNLSGSVE F	60.4	1.0650	Antigen	Allergen				
	DRB1_080 1	FDVIKTHK N	831.9	0.2574	Non- antigen					
	DRB1_090 1	FITLAIALL	678.9	-1.2241	Non- antigen					
		CNLSGSVE F	695.7	1.0650	Antigen	Allergen				

		AKNAYSLY L	1039.3	2.3423	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		ISLAQVKY T	1153.0	0.3063	Non- antigen					
	DRB1_100 1	FITLAIALL	564.4	-1.2241	Non- antigen					
		LITLPTTSN	1282.9	0.3321	Non- antigen					
		QVKYTTAS N	1630.7	1.0572	Antigen	Allergen				
		NFDVIKTH K	3965.0	1.3243	Antigen	Non- Allergen	Non-Toxin	non- inducer		
	DRB1_120 1	EISLAQVK Y	457.3	0.8786	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	Yes
		IIAKNAYSL	501.5	1.1412	Antigen	Allergen				
		IAKNAYSL Y	1015.5	1.2062	Antigen	Allergen				
	DRB1_130 1	LRIHLNTV T	60.9	1.5984	Antigen	Allergen				
	DRB1_150 1	KNIFITLAI	3395.9	-0.5021	Non- antigen					
	DRB1_160 2	YLSNRQSA S	5275.4	1.4337	Antigen	Allergen				
XP_00242 1072.1	DRB1_010 1	IYYALGAQ V	395.7	0.1022	Non- antigen					
		DNFMRSA YI	477.9	-0.7700	Non- antigen					
		FNVMKTPV D	672.5	1.0203	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		SVNVLGQ NV	965.2	2.3186	Antigen	Allergen				
		SVALKSVN V	1107.4	0.0491	Non- antigen					
		FIALDFNV M	1166.2	1.9407	Antigen	Allergen				
		FLQNILSVL	1207.4	-0.0848	Non- antigen					
	DRB1_030 1	IALDFNVM K	2415.8	3.4038	Antigen	Allergen				
		LLIDAAPV K	4137.8	0.9224	Antigen	Allergen				
		ILGDNFMR S	4195.7	0.5691	Antigen	Non- allergen	Non-toxin	Inducer	Inducer	No
		DLDDNKIS M	4206.5	1.6916	Antigen	Allergen				
		VDLDNEIIT	5090.7	1.8800	Antigen	Allergen				
		ITSDMRLSV	6843.4	2.5932	Antigen	Allergen				
		IVYDLDDN K	7039.2	2.9649	Antigen	Allergen				
		NILGDNFM R	7320.7	1.0089	Antigen	Allergen				
		VLLDSGTTI	8439.5	-1.2202	Non- antigen					
		YDLDDNKI S	9023.9	2.1088	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	No
		LIDAAPVK R	9734.0	0.9044	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	No
		IFADVWST S	10378. 7	0.4001	Non- antigen					
		PITSDMRLS	10461. 4	2.0009	Antigen	Allergen				

	DRB1_040 1	YAADITLGS	2072.3	2.1100	Antigen	Allergen				
		FIALDFNVM	2400.9	1.9407	Antigen	Allergen				
		FQFDKNLKI	2961.6	4.2801	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
		IALDFNVMK	3647.6	3.4038	Antigen	Allergen				
		LFLDIDHTG	4865.9	0.2691	Non-antigen					
		LYQDTVGLG	6313.0	1.1822	Antigen	Allergen				
		ILGDNFMRS	6720.5	0.5691	Antigen	Non-allergen	Non-toxin	Inducer	Inducer	No
		VRASESNIL	7194.8	2.1763	Antigen	Allergen				
		FADVWSTSA	7307.8	0.6188	Antigen	Allergen				
	DRB1_070 1	MRLSVALKS	41.0	0.0769	Non-antigen					
		FQPSIARNI	42.1	1.5179	Antigen	Allergen				
		IYALGAQV	54.3	0.1022	Non-antigen					
		FQFDKNLKI	88.9	4.2801	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
		VRASESNIL	147.2	2.1763	Antigen	Allergen				
		LYYTNGEPY	265.7	-1.1743	Non-antigen					
	DRB1_080 1	FNVMKTPVD	271.4	1.0203	Antigen	Non-Allergen	Non-Toxin	Inducer	Non-inducer	
	DRB1_090 1	IYALGAQV	51.8	0.1022	Non-antigen					
		ISYFQPSIA	145.7	0.2193	Non-antigen					
		VKRSPGFIA	682.8	0.2880	Non-antigen					
		MRLSVALKS	796.5	0.0769	Non-antigen					
		ILSVLAVAL	1198.3	-0.8110	Non-antigen					
		IQYADGSYA	1200.7	0.3229	Non-antigen					
	DRB1_100 1	YFQPSIARN	496.3	0.1048	Non-antigen					
		FIALDFNVM	712.5	1.9407	Antigen	Allergen				
		FIAPLYYTN	772.4	0.6606	Antigen	Allergen				
		FLQNILSVL	863.5	-0.0848	Non-antigen					
		ISYFQPSIA	940.3	0.2193	Non-antigen					
		YSLFLNSPE	1124.3	1.9003	Antigen	Allergen				
		FNVMKTPVD	1359.7	1.0203	Antigen	Non-Allergen	Non-Toxin	Inducer	Non-inducer	
		KISMAPVKY	1405.8	0.9678	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
	DRB1_110 1	MRLSVALKS	1760.8	0.0769	Non-antigen					
		LPISMKKQG	3423.7	-0.3080	Non-antigen					
	DRB1_120 1	IISKNAYSL	654.3	1.1884	Antigen	Allergen				
		VRAKRSPLF	744.5	0.4167	Non-antigen					

		KISMAPVK Y	1067.6	0.9678	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	No
		SVALKSVN V	1109.6	0.0491	Non- antigen					
		IYALGAQ V	1515.8	0.1022	Non- antigen					
	DRB1_130 1	MRLSVALK S	27.6	0.0769	Non- antigen					
		FMR SAYIV Y	42.4	-0.8316	Non- antigen					
	DRB1_150 1	IYALGAQ V	324.3	0.1022	Non- antigen					
	DRB1_160 2	FQFDKNLK I	3821.4	4.2801	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	No
		FLQNILSVL	4387.9	-0.0848	Non- antigen					
		FIALDFNV M	4783.5	1.9407	Antigen	Allergen				
		SLFLNSPEA	5103.2	1.2572	Antigen	Non- Allergen	Non-Toxin	non- inducer		
XP_00241 9185.1	DRB1_010 1	FNFAKGV T I	291.9	1.2688	Antigen	Allergen				
		FALLAQGL A	563.6	-1.7523	Non- antigen					
		ITFTKNVLV	1281.0	1.3861	Antigen	Allergen				
		TGSLTALPI	1362.1	1.4861	Antigen	Allergen				
		SLYLNSAS A	1494.0	0.3165	Non- antigen					
	DRB1_030 1	ILGDNFLR	1157.5	0.6629	Antigen	Non- allergen	Inducer	Non- inducer		
		VSLDFTVT R	2195.4	2.1928	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	No
		VLQDGN SC Y	5165.9	-1.3037	Non- antigen					
		TILGDNFL R	5725.3	0.4585	Antigen	Allergen				
	DRB1_040 1	YTSSCNLS G	2195.6	1.2123	Antigen	Allergen				
		FAKGV TIS V	2456.5	1.8396	Antigen	Allergen				
		YSLYLSA S	2524.3	1.0637	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		YLNSASAS S	3184.2	0.5536	Antigen	Allergen				
		LYTSSCNLS	3188.2	1.4223	Antigen	Allergen				
		YTTSSSIST	3414.3	2.0743	Antigen	Allergen				
		LYLNSASA S	4141.2	0.4779	Non- antigen					
		YAATITVG S	5119.1	1.1851	Antigen	Allergen				
		FVLQDGNS C	5989.2	-0.5260	Non- antigen					
		VQLSTINIA	6273.4	0.7202	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		FADVTTTSI	6574.8	-0.5297	Non- antigen					
		YYQLYTSS C	6970.7	0.9649	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
	DRB1_070 1	FNFAKGV T I	8.3	1.2688	Antigen	Allergen				
		ITFTKNVLV	21.4	1.3861	Antigen	Allergen				
		VKYTTSSSI	26.5	1.2955	Antigen	Allergen				



		KGVTISVPL	118.3	2.9703	Antigen	Allergen				
		FSQTIADKL	135.2	-0.9443	Non-antigen					
		LPITSSNEL	247.0	1.5083	Antigen	Allergen				
		AEKVVSDF	312.4	2.4086	Antigen	Allergen				
	DRB1_0801	FTVTRKPFN	302.2	0.8944	Antigen	Allergen				
		FLRRAYAVY	691.7	0.6191	Antigen	Non-Allergen	Non-Toxin	Inducer	Non-inducer	
		FALLAQGLA	768.8	-1.7523	Non-antigen					
		FNFAKGVTI	771.1	1.2688	Antigen	Allergen				
		DFTVTRKPF	874.6	2.7000	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
	DRB1_0901	FNFAKGVTI	166.9	1.2688	Antigen	Allergen				
		ALLAQGLAI	696.7	-0.6422	Non-antigen					
		AFALLAQGL	774.5	-1.9549	Non-antigen					
		VKYTTSSSI	776.1	1.2955	Antigen	Allergen				
		LRRAYAVYD	913.4	0.6369	Antigen	Non-Allergen	Non-Toxin	Inducer	Non-inducer	
		LGKAFSIQY	1035.5	4.5208	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
		ISLAQVKYT	1153.0	0.3063	Non-antigen					
	DRB1_1001	YSLYLNSAS	659.1	1.0637	Antigen	Non-Allergen	Non-Toxin	Inducer	Non-inducer	
		YFSQTIADK	752.7	-1.8456	Non-antigen					
		YYQLYTSSC	793.3	0.9649	Antigen	Non-Allergen	Non-toxin	Inducer	Non-inducer	
		YAATITVGS	853.2	1.1851	Antigen	Allergen				
		YLNSASASS	917.6	0.5536	Antigen	Allergen				
		AFALLAQGL	1653.3	-1.9549	Non-antigen					
	DRB1_1101	FALLAQGLA	2987.8	-1.7523	Non-antigen					
		YFGVSRDSA	3613.0	1.7871	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
	DRB1_1201	TISLAQVKY	170.2	0.4755	Non-antigen					
		IINKNAYSL	692.0	0.3997	Non-antigen					
		INKNAYSLY	1359.6	0.8450	Antigen	Allergen				
		LWVIDSAAV	1928.1	0.4765	Non-antigen					
		AFALLAQGL	1985.2	-1.9549	Non-antigen					
	DRB1_1301	FLRRAYAVY	30.2	0.6191	Antigen	Non-Allergen	Non-Toxin	Inducer	Non-inducer	
		IITFTKNVL	61.4	0.0064	Non-antigen					
	DRB1_1501	IITFTKNVL	2197.7	0.0064	Non-antigen					
		IVFNFAKGV	3669.4	-0.4898	Non-antigen					

		LRRAYAVY D	4314.5	0.6369	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		ITFTKNVLV	4788.9	1.3861	Antigen	Allergen				
	DRB1_160 2	YSLYLSA S	2031.2	1.0637	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		YYQLYTSS C	3211.6	0.9649	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
		LWVIDSAA V	3328.6	0.4765	Non- antigen					
		YLNSASAS S	3950.7	0.5536	Antigen	Allergen				
		LYLNSASA S	4387.3	0.4779	Non- antigen					
		SLYLSAS A	5247.2	0.3165	Non- antigen					
XP_00241 9306.1	DRB1_010 1	DNILRSAYI	343.4	-1.2703	Non- antigen					
		LVLQAGRS T	456.9	-0.0958	Non- antigen					
		YSRSVGAYI	587.8	2.3929	Antigen	Allergen				
		FYMATLKI G	768.0	-1.0905	Non- antigen					
		LSFAIANET	792.7	0.3221	Non- antigen					
		GIIAKSLYS	820.0	-1.2680	Non- antigen					
		GIGLPGLE V	884.2	1.3368	Antigen	Non- Allergen	Non-Toxin	Non- inducer		
		YELLSLLV	943.2	-0.2083	Non- antigen					
		LLSLVATA L	1219.1	-1.6212	Non- antigen					
		LSLVATAL A	1342.9	-0.7118	Non- antigen					
		FGHGTGV KL	1454.1	5.1289	Antigen	Non- Allergen	Non-Toxin	Inducer	Inducer	No
		SYMLFGDN I	1493.7	2.4644	Antigen	Allergen	Non-Toxin	non- inducer		
		TFYMATLK I	1598.5	-0.8843	Non- antigen					
	DRB1_030 1	MLFGDNIL R	1041.7	-0.4587	Non- antigen					
		LFGDNILRS	1775.0	-0.6090	Non- antigen					
		FKIDFEVRR	2388.4	4.0706	Antigen	Allergen				
		VKRDGSLD M	3799.3	-0.2475	Non- antigen					
		VKLNEREL L	4188.7	0.3780	Non- antigen					
		MSHDLKC VS	4665.0	0.7753	Antigen	Allergen				
		MRLNSVAL L	5169.1	-0.3058	Non- antigen					
		LKADGIIA K	5340.5	-0.4177	Non- antigen					
		VVISNVT K	5885.6	-0.8969	Non- antigen					
		LLQKRKNL Y	8005.7	0.1840	Non- antigen					
		WGYDDVV IS	10291. 9	0.0007	Non- antigen					
		VMSHDLK CV	10365. 8	0.9801	Antigen	Non- allergen	Non-toxin	Non- inducer		

		MTLTNKQ TF	10485.3	-0.3736	Non-antigen					
	DRB1_040 1	LFGDNILRS	1456.4	-0.6090	Non-antigen					
		VMLQSSSSS	1778.8	0.1853	Non-antigen					
		YIVNCNLAD	2884.9	0.8797	Antigen	Allergen				
		LKADGIIAK	3418.9	-0.4177	Non-antigen					
		VKMMRTYSQ	4395.0	1.7438	Antigen	Non-Allergen	Non-Toxin	non-inducer		
		YVFSDTLES	4546.6	-0.0415	Non-antigen					
		MLQSSSSSY	4839.3	0.2578	Non-antigen					
		LYSLYLNSA	5024.7	0.5498	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
		AYIVNCNLA	5723.0	1.6761	Antigen	Allergen				
		GVMLQSSSS	6075.4	-0.2978	Non-antigen					
		WGYDDVVIS	6466.8	0.0007	Non-antigen					
		YLNSADAKA	7016.9	1.9136	Antigen	Allergen				
		FAIANETSS	7090.9	0.8806	Antigen	Allergen				
	DRB1_070 1	YRSVGAYI	11.4	2.3929	Antigen	Allergen				
		LATTAPFKI	63.0	0.5613	Antigen	Allergen				
		IEVIGASGI	69.8	-0.1658	Non-antigen					
		LQSSSSSYM	207.3	0.8152	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	Yes
		TFYMATLK	219.7	-1.3896	Non-antigen					
		LQAGRSTCI	245.2	2.8295	Antigen	Allergen				
		FGHGTGVLK	255.4	5.1289	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
		LSFAIANET	273.8	0.3221	Non-antigen					
		LSLVATALA	312.7	-0.7118	Non-antigen					
	DRB1_080 1	FYMATLKI G	192.6	-1.0905	Non-antigen					
		LVTVKMMRT	350.7	0.1990	Non-antigen					
		TFYMATLKI	373.3	-1.3896	Non-antigen					
		LWVMSHDLK	738.1	3.2205	Antigen	Allergen				
	DRB1_090 1	YRSVGAYI	49.2	2.3929	Antigen	Allergen				
		LQSSSSSYM	202.1	0.8152	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	Yes
		MLQSSSSSY	376.1	0.2578	Non-antigen					
		FGHGTGVLK	597.8	5.1289	Antigen	Non-Allergen	Non-Toxin	Inducer	Inducer	No
		LLSLVATAL	611.6	-1.6212	Non-antigen					

		MRLNSVAL L	703.4	-0.3058	Non- antigen					
		LATTAPFKI	847.1	0.5613	Antigen	Allergen				
		AYSTFSPFV	912.3	0.7045	Antigen	Allergen				
		TRHSAGSII	1013.2	2.4237	Antigen	Allergen				
		YSTFSPFVG	1208.7	1.4934	Antigen	Allergen				
	DRB1_100 1	YMATLKIG S	300.1	0.3131	Non- antigen					
		VKMMRTY SQ	614.1	1.7438	Antigen	Non- Allergen	Non-Toxin	non- inducer		
		YEVSLAQV S	662.2	0.4008	Non- antigen					
		YSRSGAYI	870.5	2.3929	Antigen	Allergen				
		TVKMMRT YS	934.6	1.2009	Antigen	Allergen				
		LLSLVATA L	1139.5	-1.6212	Non- antigen					
		YELLSLLV	1183.3	-0.2083	Non- antigen					
		YSLYLNSA D	1476.6	1.7845	Antigen	Allergen				
	DRB1_110 1	YMATLKIG S	215.7	0.3131	Non- antigen					
		FYMATLKI G	869.7	-1.0905	Non- antigen					
		TVKMMRT YS	2508.8	1.2009	Antigen	Allergen				
		RELLQKRK N	3469.0	0.4633	Non- antigen					
		YQNLPLKL K	4201.2	-0.6437	Non- antigen					
	DRB1_120 1	VTVKMMR TY	270.1	1.2038	Antigen	Non- Allergen	Non-Toxin	non- inducer		
		IAKSLYSLY	520.9	0.6837	Antigen	Allergen				
		EVSLAQVS Y	782.2	0.0927	Non- antigen					
		IIAKSLYSL	1314.5	-0.5713	Non- antigen					
		LLQKRKNL Y	1594.5	0.1840	Non- antigen					
		LLSLVATA L	2158.6	-1.6212	Non- antigen					
	DRB1_130 1	LVTVKMM RT	22.4	0.1990	Non- antigen					
		LLQKRKNL Y	23.5	0.1840	Non- antigen					
		VRIQVPVS K	31.5	1.8396	Antigen	Allergen				
		LVLQAGRS T	32.4	-0.0958	Non- antigen					
		VTVKMMR TY	38.1	1.2038	Antigen	Non- Allergen	Non-Toxin	non- inducer		
		MRLNSVAL L	39.9	-0.3058	Non- antigen					
		ILRSAYIVY	50.8	-1.0241	Non- antigen					
		MRTYSQISY	62.3	-0.6069	Non- antigen					
		LLSLVATA L	65.2	-1.6212	Non- antigen					
	DRB1_150 1	YSRSGAYI	950.3	2.3929	Antigen	Allergen				

		AKSLYSLYL	1936.3	1.2197	Antigen	Allergen				
		IFGFGSVYS	2261.3	-0.6350	Non-antigen					
		IWGYDDV VI	2881.8	0.5754	Antigen	Non-allergen	Non-toxin	Inducer	Inducer	Yes
		LSLLVAYC V	3024.6	1.4798	Antigen	Non-Allergen	Non-Toxin	Inducer	Non-inducer	
		YMLFGDNI L	3067.9	1.0484	Antigen	Allergen				
		LLSLVAY C	3359.2	0.8941	Antigen	Allergen				
		SVALLSLV A	3479.0	-0.5179	Non-antigen					
		LLSLVATA L	4882.9	-1.6212	Non-antigen					
		YELLSLLV	4968.3	-0.2083	Non-antigen					
	DRB1_160 2	YMLFGDNI L	2347.9	1.0484	Antigen	Allergen				
		YELLSLLV	2429.2	-0.2083	Non-antigen					
		YMATLKIG S	3247.8	0.3131	Antigen	Allergen				
		LLSLVATA L	4710.8	-1.6212	Non-antigen					
		IFGFGSVYS	5342.7	-0.6350	Non-antigen					
		AKSLYSLYL	5436.0	1.2197	Antigen	Allergen				
		GVMLQSSS S	5440.0	-0.2978	Non-antigen					
XP_00242 0070.1	DRB1_010 1	YLAIMSNS V	159.0	0.0106	Non-antigen					
		LAIMSNSVI	281.7	-0.9463	Non-antigen					
		WIDALGRS L	1055.4	0.3362	Non-antigen					
		LKIGIANRS	1125.1	-1.2872	Non-antigen					
	DRB1_030 1	LFGDDILR R	238.2	-0.2876	Non-antigen					
		ILFGDDILR	686.6	-0.2307	Non-antigen					
		VLLDTGST F	2548.2	-2.5278	Non-antigen					
		IKLDFNIVS	2687.0	1.9926	Antigen	Allergen				
		LVYDLQD MT	3253.1	0.8536	Antigen	Allergen				
		IFNDIDQEY	3435.2	-0.0513	Non-antigen					
		VMSNDAIC Y	3763.8	-0.8864	Non-antigen					
		PLINDKILY	3821.1	-1.4843	Non-antigen					
		YLVDLQD M	9571.3	0.4453	Non-antigen					
		IFPDEWID A	10094. 6	-0.0672	Non-antigen					
	DRB1_040 1	IKLDFNIVS	931.6	1.9926	Antigen	Allergen				
		YLAIMSNS V	2161.8	0.0106	Non-antigen					
		VYLNSSNS T	3543.1	1.2584	Antigen	Allergen				

		LFGDDILR R	4677.4	-0.2876	Non- antigen					
		LKIGIANRS	5241.8	-1.2872	Non- antigen					
		YSVYLNSS N	6203.4	1.5311	Antigen	Allergen				
		YLNSSNST T	7227.6	1.9050	Antigen	Non- Allergen	Non-Toxin	Inducer	Non- inducer	
	DRB1_070 1	YLAIMSNS V	45.8	0.0106	Non- antigen					
		ILYTTELEI	114.8	0.8142	Antigen	Allergen				
	DRB1_080 1	LYLASVVK C	267.0	-1.4903	Non- antigen					
		LLYLASVV K	852.6	-2.2039	Non- antigen					
	DRB1_090 1	FFGFSIGNA	960.1	0.0797	Non- antigen					
		MTISVAPV A	973.5	0.7395	Antigen	Allergen				
		WIDALGRS L	1189.7	0.3362	Non- antigen					
	DRB1_100 1	YLAIMSNS V	121.7	0.0106	Non- antigen					
		YSVYLNSS N	470.4	1.5311	Antigen	Allergen				
		FLLYLASV V	1024.2	-1.6177	Non- antigen					
		FFGFSIGNA	1131.2	0.0797	Non- antigen					
	DRB1_110 1	YLAIMSNS V	2710.3	0.0106	Non- antigen					
		YLASVVKC S	4377.9	-1.1056	Non- antigen					
	DRB1_120 1	INKIAYSVY	375.9	-0.6434	Non- antigen					
		LINKIAYSV	764.2	-1.5125	Non- antigen					
		VMSNDAIC Y	1003.0	-0.8864	Non- antigen					
		ILRRIYLVY	1710.6	-0.2414	Non- antigen					
		PLINDKILY	1863.2	-1.4843	Non- antigen					
		YLAIMSNS V	1951.2	0.0106	Non- antigen					
	DRB1_130 1	ILRRIYLVY	26.1	-0.2414	Non- antigen					
		LKIGIANRS	36.5	-1.2872	Non- antigen					
		LLYLASVV K	63.1	-2.2039	Non- antigen					
	DRB1_150 1	NKIAYSVY L	1527.3	0.5472	Antigen	Allergen				
		YLAIMSNS V	1965.9	0.0106	Non- antigen					
		VWGYDSV QF	2310.5	-0.4405	Non- antigen					
		LAIMSNSVI	2317.5	-0.9463	Non- antigen					
		FLLYLASV V	3003.0	-1.6177	Non- antigen					
		RRIYLVYDL	4647.7	1.9460	Antigen	Allergen				

	DRB1_160 2	YLAIMSNS V	684.5	0.0106	Non- antigen					
		FLLYLASV V	1788.5	-1.6177	Non- antigen					
		LWVMSND AI	3399.7	1.3804	Antigen	Allergen				
		FFGFSIGNA	4042.9	0.0797	Non- antigen					
		YSVYLNSS N	4482.6	1.5311	Antigen	Allergen				
		CYLAIMSN S	5422.4	0.6931	Antigen	Allergen				

Table S2: Protein ids with corresponding predicted T<sub>c</sub> cell epitopes with their corresponding calculated parameters

Protein ID	Allele	Peptide	Binding Affinity (nM)	Vaxijen score	Antigen/ Non-antigen	Allergenicity	Toxicity	IL-2 inducer	IL-4 inducer	IFNepitope
XP_002421073.1	HLA-A*01:01	GSSSHGTLTY	144.8	0.9695	Antigen	Non-allergen	Non-Toxin	Inducer	Inducer	Yes
		KTNEAAGDY	549.7	1.2788	Antigen	Allergen				
		ASEFTASLF	686.8	0.2726	Non-antigen					
	HLA-A*02:01	FLKNIFIAL	26.5	-0.1943	Non-antigen					
	HLA-A*03:01	SSSHGTLYK	41.9	0.4811	Non-antigen					
	HLA-A*26:01	EISLAQVKY	572.7	0.8786	Antigen	Non-allergen	Non-Toxin	Inducer	Inducer	Yes
		EVVSYAADI	639.4	1.9098	Antigen	Allergen				
		DTVGFGGAS	1327.2	1.3930	Antigen	Allergen				
	HLA-B*07:02	SPNAATGQI	24.8	1.8632	Antigen	Allergen				
		TPAKRSAGF	32.7	0.2214	Non-antigen					
		VPVTSREL	180.1	2.2722	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
	HLA-B*08:01	FLKNIFIAL	19.4	-0.1943	Non-antigen					
		DGKVKRQAI	50.0	0.0835	Non-antigen					
		SNRQKFNVV	52.6	0.7537	Antigen	Non-allergen	Non-Toxin		Inducer	No
	HLA-B*27:05	KRQAIPVTL	49.1	0.1663	Non-antigen					
		KRSAGFVTL	56.2	0.3515	Non-antigen					
		QRLGNPFYI	118.9	1.8625	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
		LRITLNSIK	128.5	0.3099	Non-antigen	Allergen				
	HLA-B*39:01	NRQKFNVVV	117.3	-0.0053	Non-antigen					
		KRSAGFVTL	179.8	0.3515	Non-antigen					
		KQDGNGNSL	304.8	2.8548	Antigen	Allergen				
		QRLGNPFYI	332.6	1.8625	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
		KRQAIPVTL	396.0	0.1663	Non-antigen					
	HLA-B*58:01	RSAYIVYDL	36.9	-0.2506	Non-antigen					
XP_002422286.1	HLA-A*01:01	GSSSQGTLY	161.2	0.9782	Antigen	Non-allergen	Non-Toxin		Inducer	No
		KTNEAGGDY	554.5	1.5254	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
		NTDNVDVLL	627.5	1.6703	Antigen	Allergen				
	HLA-A*02:01	FLKNIFIAL	26.5	-0.1943	Non-antigen					
		FIALAIAL	34.7	-1.6002	Non-antigen					
	HLA-A*03:01	SSSQGTLYK	81.7	0.1643	Non-antigen					
	HLA-A*24:02	TYSKCQLLF	15.6	-0.4281	Non-antigen					
		KYSGSLITL	113.2	1.8834	Antigen	Non-allergen	Non-Toxin		Inducer	No
		TYSDQTADF	213.0	-0.4834	Non-antigen					
	HLA-A*26:01	EISLAQVKY	572.7	0.8786	Antigen	Non-allergen	Non-Toxin	Inducer	Inducer	Yes
		DTVGFGGAS	1327.2	1.3930	Antigen	Allergen				



	HLA-B*07:02	SPNAATGQI	24.8	1.8632	Antigen	Allergen				
		LPVTSNTEL	49.8	1.6314	Antigen	Non-allergen	Non-Toxin		Inducer	No
	HLA-B*08:01	FLKNIFIAL	19.4	- 0.1943	Non-antigen					
	HLA-B*27:05	KRSAGFVAL	46.2	- 0.0738	Non-antigen					
		KRQAIPVTL	49.1	0.1663	Non-antigen					
	HLA-B*39:01	KRSAGFVAL	97.9	- 0.0738	Non-antigen					
		KRQAIPVTL	396.0	0.1663	Non-antigen					
	HLA-B*58:01	RSAYIVYDL	36.9	- 0.2506	Non-antigen					
		VSGDVVFNF	58.4	0.1217	Non-antigen					
XP_00241 9429.1	HLA-A*01:01	ASEFTAPLY	27.4	1.4721	Antigen	Non-allergen	Non-Toxin		Inducer	No
		YDANGNLFY	342.8	0.5718	Antigen	Allergen				
		GTTSQGTWY	702.6	- 0.2215	Non-antigen					
		LNNPFSIEY	1028.1	2.8077	Antigen	Non-allergen	Non-Toxin	Inducer	Inducer	Yes
	HLA-A*02:01	FLKNIFITL	26.7	- 0.2901	Non-antigen					
		LLNEQVSYA	27.1	- 0.7659	Non-antigen					
		LLVDAIPTT	37.6	- 0.2254	Non-antigen					
	HLA-A*24:02	VYDQCQLLF	75.5	- 0.9237	Non-antigen					
		TWYKDTIGF	96.7	- 0.4828	Non-antigen					
		KYSGSLITL	113.2	1.8834	Antigen	Non-allergen	Non-Toxin		Inducer	No
		TYDANGNLF	116.7	1.8277	Antigen	Allergen				
		YYDNVPVTL	284.9	- 0.0769	Non-antigen					
	HLA-A*26:01	ETYDANGNL	156.0	1.7976	Antigen	Non-allergen	Non-Toxin		Inducer	No
		TTASNIAAL	174.0	1.7343	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
		EISLAQVKY	572.7	0.8786	Antigen	Non-allergen	Non-Toxin	Inducer	Inducer	Yes
	HLA-B*07:02	LPTTSNSEL	43.8	0.7389	Antigen	Non-allergen	Non-Toxin		Inducer	No
	HLA-B*08:01	FLKNIFITL	31.6	- 0.2901	Non-antigen					
		ELRIHLNTV	57.8	2.0948	Antigen	Allergen				
		LAQVKYTTA	147.2	0.4669	Non-antigen					
		NVKRQTVPV	151.9	0.5811	Antigen	Allergen				
	HLA-B*27:05	KRQTVPVTL	81.4	0.5626	Antigen	Allergen				
	HLA-B*39:01	YYDNVPVTL	228.2	- 0.0769	Non-antigen					
	HLA-B*58:01	LSGSVEFAF	21.3	1.5882	Antigen	Allergen				
		RSAYIVYDL	36.9	- 0.2506	Non-antigen					
XP_00242 1072.1	HLA-A*01:01	ASEFIAPLY	25.2	1.3635	Antigen	Non-allergen	Non-Toxin		Inducer	No
		DLDNEIITY	343.6	1.1393	Antigen	Non-allergen	Non-Toxin		Inducer	No

		GSYARGNLY	702.3	- 1.7592	Non-antigen					
		FADVWSTSA	1027.9	0.6188	Antigen	Allergen				
	HLA-A*02:01	FLQNILSVL	12.2	- 0.0848	Non-antigen					
		ALLIDAAPV	21.8	0.0127	Non-antigen					
		FQFDKNLKI	35.0	4.2801	Antigen	Non-allergen	Non-Toxin		Inducer	No
	HLA-A*03:01	GILGIGFQK	94.2	- 0.2299	Non-antigen					
	HLA-A*26:01	DTVGLGGAF	10.3	2.7130	Antigen	Allergen				
		FIALDFNVM	1015.6	1.9407	Antigen	Allergen				
		NIQYADGSY	1123.4	- 0.2216	Non-antigen					
	HLA-B*07:02	TVRAKRSPL	29.2	1.1786	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
		QPSIARNII	42.0	0.9904	Antigen	Non-allergen	Non-Toxin		Inducer	No
		APVKRSPGF	52.3	0.8451	Antigen	Non-allergen	Non-Toxin		Inducer	No
		SPEASTGQI	137.8	1.9382	Antigen	Allergen				
		IARNIIYAL	167.4	- 0.8004	Non-antigen					
	HLA-B*08:01	TVRAKRSPL	20.9	1.1786	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
		IARNIIYAL	131.4	- 0.8004	Non-antigen					
		FLQNILSVL	184.1	- 0.0848	Non-antigen					
	HLA-B*27:05	KRSPGFIAL	67.9	- 0.5262	Non-antigen					
		KRSPLFLDI	82.4	- 2.1045	Non-antigen					
	HLA-B*39:01	KRSPGFIAL	131.8	- 0.5262	Non-antigen	Non-allergen	Non-Toxin		Non-Inducer	No
		VRASESNIL	215.7	2.1763	Antigen	Allergen				
		FQFDKNLKI	246.4	4.2801	Antigen	Non-allergen	Non-Toxin		Inducer	No
		SKNAYSLFL	316.7	1.5126	Antigen	Allergen				
		FLQNILSVL	492.9	- 0.0848	Non-antigen					
	HLA-B*58:01	RSAYIVYDL	36.9	- 0.2506	Non-antigen					
		TSGTVDFQF	74.3	0.3215	Non-antigen					
		ISVPASEFI	81.4	1.9174	Antigen	Allergen				
		YALGAQVHF	82.2	3.6766	Antigen	Allergen				
XP_00241 9185.1	HLA-A*01:01	GSSSQGTVY	863.0	1.3521	Antigen	Allergen				
	HLA-A*02:01	VLVALAFAL	21.4	- 0.0040	Non-antigen					
	HLA-A*03:01	KLAAAVGA K	13.3	1.3284	Antigen	Allergen				
		MVSIITFTK	37.6	- 0.0476	Non-antigen					
		ATITVGSNK	56.0	1.6427	Antigen	Allergen				
		SLDFTVTRK	131.3	2.1115	Antigen	Non-allergen	Non-Toxin		Inducer	No
		SSSQGTVYK	138.8	0.5699	Antigen	Allergen				
	HLA-A*24:02	TYPGQSPTF	36.2	2.0790	Antigen	Allergen				

	HLA-A*26:01	FTKNVLVAL	757.5	0.9724	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
		FLRRAYAVY	1400.2	0.6191	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
	HLA-B*07:02	HPAQKRGTV	8.5	0.4227	Non-antigen					
		LPITSSNEL	41.2	1.5083	Antigen	Allergen				
	HLA-B*08:01	NFLRRAYAV	78.0	0.8450	Antigen	Allergen				
		ELRVQLSTI	155.8	1.7528	Antigen	Non-allergen	Non-Toxin	Non-inducer	Inducer	Yes
		HPAQKRGTV	203.8	0.4227	Non-antigen					
	HLA-B*27:05	RRAYAVYDL	35.3	0.6139	Antigen	Allergen				
		KRAEKVVSL	36.6	0.7044	Antigen	Allergen				
		KRGTVQTSL	102.4	- 0.6252	Non-antigen					
	HLA-B*39:01	NKNAYSLYL	103.0	1.8591	Antigen	Allergen				
		KRAEKVVSL	168.7	0.7044	Antigen	Allergen				
		RRAYAVYDL	328.6	0.6139	Antigen	Allergen				
		FADVTTTSI	340.5	- 0.5297	Non-antigen					
		LPITSSNEL	525.5	1.5083	Antigen	Allergen				
	HLA-B*58:01	LAAAVGAK W	3.6	1.2019	Antigen	Allergen				
		LSGNIVFNF	24.3	0.5158	Antigen	Allergen				
XP_002419306.1	HLA-A*01:01	VTSQYGHTY	103.8	1.2978	Antigen	Non-allergen	Non-Toxin		Inducer	No
		YTDKESIEV	109.0	1.6265	Antigen	Non-allergen	Non-Toxin		Inducer	No
		TSAIGIWGY	228.8	2.6174	Antigen	Allergen				
		NTYPFQIQY	450.1	2.2249	Antigen	Allergen				
		SSDLWVMSh	576.2	1.6375	Antigen	Allergen				
		LTNKQTFYM	626.2	- 0.4471	Non-antigen					
		MLQSSSSSY	795.0	0.2578	Non-antigen					
	HLA-A*02:01	ILFGAIDHA	18.3	- 1.4064	Non-antigen					
		YMLFGDNIL	18.6	1.0484	Antigen	Allergen				
		LLVAYCVLV	21.3	0.8605	Antigen	Allergen				
		ALLSLVATA	30.5	- 0.8798	Non-antigen					
		NLDDYEVSL	34.7	1.7735	Antigen	Allergen				
	HLA-A*03:01	ALATTAPFK	16.0	0.0970	Non-antigen					
		HTYQNLPLK	27.4	- 0.4843	Non-antigen					
		QTFYMATLK	27.7	- 1.0773	Non-antigen					
		KIFGFGSVY	42.3	- 1.2376	Non-antigen					
		HSAGSIIAK	128.6	0.7391	Antigen	Non-allergen	Non-Toxin		Inducer	No
	HLA-A*24:02	SYMLFGDNI	18.0	2.4644	Antigen	Allergen	Non-Toxin		Inducer	No
		TYSQISYPV	71.7	- 0.1068	Non-antigen					
		TYQNLPLKL	73.8	- 0.2858	Non-antigen					
		KYQGDLVTV	127.6	2.5881	Antigen	Non-allergen	Non-Toxin		Inducer	No

		QYGHTYQNL	204.8	- 1.0397	Non-antigen					
		MYELLSLL	219.3	- 0.6592	Non-antigen					
	HLA-A*26:01	DTFKENNTY	72.7	- 0.8235	Non-antigen					
		EVSLAQVSY	123.3	0.0927	Non-antigen					
		NTYPFQIQY	189.1	2.2249	Antigen	Allergen				
		YITEGPGAY	191.2	1.4188	Antigen	Allergen				
		YIVYNLDDY	413.9	1.3377	Antigen	Allergen				
		VTVKMMRTY	440.1	1.2038	Antigen	Non-allergen	Non-Toxin		Inducer	No
		ETSSDVGVL	466.2	2.1428	Antigen	Non-allergen	Non-Toxin		Inducer	
		ESIEVIGAS	646.7	1.6509	Antigen	Non-allergen	Non-Toxin		Inducer	No
		TSAIGIWGY	922.6	2.6174	Antigen	Allergen				
		EVIGASGIT	1112.8	0.9929	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
	HLA-B*07:02	YPVRIQVPV	48.8	1.6273	Antigen	Non-allergen	Non-Toxin	Non-inducer	Inducer	Yes
	HLA-B*08:01	ELLQKRKNL	80.9	0.8448	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
	HLA-B*27:05	MRLNSVALL	14.5	- 0.3058	Non-antigen					
		GRSTCILGV	49.9	3.5563	Antigen	Non-allergen	Non-Toxin		Inducer	
	HLA-B*39:01	MRLNSVALL	39.8	- 0.3058	Non-antigen					
		GHTYQNLPL	49.8	- 1.2986	Non-antigen					
		FKENNTYPF	117.7	0.1848	Non-antigen					
		YMLFGDNIL	129.3	1.0484	Antigen	Allergen				
		YPVRIQVPV	235.9	1.6273	Antigen	Non-allergen	Non-Toxin	Non-inducer	Inducer	Yes
		SRSVGAYIV	302.1	2.4382	Antigen	Non-allergen	Non-Toxin		Inducer	No
		NLDDYEVS	540.9	1.7735	Antigen	Allergen				
	HLA-B*40:01	IEFGGNKTI	30.4	3.0335	Antigen	Non-allergen	Non-Toxin		Inducer	No
		YELLSLLV	58.6	- 0.2083	Non-antigen					
		IEVIGASGI	79.6	- 0.1658	Non-antigen					
	HLA-B*58:01	RSAYIVYNL	19.6	- 0.4282	Non-antigen					
		SSSSYMLF	24.0	1.3657	Antigen	Non-allergen	Non-Toxin	Non-inducer	Inducer	Yes
		MTLTNKQTF	46.8	- 0.3736	Non-antigen					
		LATTAPFKI	99.3	0.5613	Antigen	Allergen				
XP_002420070.1	HLA-A*01:01	TSEDFSIGY	18.5	2.2932	Antigen	Non-allergen	Non-Toxin		Inducer	No
		TTEKDGQCY	68.4	- 0.2177	Non-antigen					
		YSCTVNGTY	268.1	0.9381	Antigen	Allergen	Non-Toxin		Inducer	No
	HLA-A*02:01	YLAIMSNSV	6.8	0.0106	Non-antigen					
		FLLYLASVV	11.1	- 1.6177	Non-antigen					
		ILFGAIDHA	18.3	- 1.4064	Non-antigen					

	HLA-A*03:01	LLYLASVVK	32.4	-2.2039	Non-antigen					
		SVAPVAYTK	68.1	0.5889	Antigen	Allergen				
		MSNDAICYK	94.0	-0.5368	Non-antigen					
	HLA-A*24:02	GYDENFFGF	57.4	3.5318	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
		VWGYDSVQF	77.7	-0.4405	Non-antigen					
		KYGVTDLKI	245.6	0.1226	Non-antigen					
	HLA-A*26:01	SAAQGVWGY	243.7	2.2386	Antigen	Allergen				
		DTGSTFSIF	347.6	1.6727	Antigen	Non-allergen	Non-Toxin		Inducer	No
		SVSIDTGSY	374.7	0.6273	Antigen	Allergen				
		NIVSTPSKY	680.3	0.9384	Antigen	Allergen				
		YTKRDALPM	830.3	-0.1044	Non-antigen					
		SVIGGGGIL	1000.4	0.7068	Antigen	Non-allergen	Non-Toxin		Non-Inducer	
	HLA-B*07:02	VPINSESQL	125.5	0.2740	Non-antigen					
	HLA-B*08:01	NMKKATSSA	158.3	1.7158	Antigen	Non-allergen	Non-Toxin		Inducer	No
		DILRRIYLV	217.7	0.0743	Non-antigen					
	HLA-B*27:05	RRIYLVYDL	13.6	1.9460	Antigen					
		KRDALPMPL	107.0	-0.3873	Non-antigen					
	HLA-B*39:01	FQTEGAPQL	21.4	-0.9693	Non-antigen					
		NHNEDQNEL	31.8	0.0011	Non-antigen					
		FPDEWIDAL	35.7	0.3194	Non-antigen					
		DHAKYDGA L	57.5	-1.1694	Non-antigen					
		NKIAYSVYL	58.2	0.5472	Antigen	Allergen				
		KRDALPMPL	88.4	-0.3873	Non-antigen					
		DKILYTTTEL	196.6	-0.5927	Non-antigen					
		NKDKVSVSI	271.1	1.2857	Antigen	Allergen				
		NRSSVSDGI	411.1	0.4858	Non-antigen					
		RRIYLVYDL	442.6	1.9460	Antigen	Allergen				
		SKYTKRDAL	476.4	0.4425	Non-antigen					
	HLA-B*40:01	SESQSVNV	86.2	1.9516	Antigen	Non-allergen	Non-Toxin		Inducer	No
		DENFFGFSI	177.2	2.1617	Antigen	Allergen				
		TEKDGQCYL	255.7	-0.2591	Non-antigen					
		SEDFSIGYV	260.2	1.7729	Antigen	Non-allergen	Non-Toxin	Non-inducer	Inducer	Yes
	HLA-B*58:01	CSIKLDFNI	72.2	3.3290	Antigen	Allergen				

Table S3: Protein ids with corresponding predicted B- cell epitopes with their corresponding calculated parameters

Protein ID	Peptide	Vaxijen score	Antigen /Non-antigen	Allergenicity	Toxicity	IL-2 inducer	IL-4 inducer	IFNepitope
>XP_002421073.1	PVNATGQDGKVKR	1.7534	Antigen	Non-allergen	Non-toxin	Inducer	Inducer	Yes
	DTGSSDLWI	0.4040	Non-antigen					
	SVTCENPPPGQSADFC	1.1736	Antigen	Allergen				
	GLYTPKSSTTSQRLG	0.9182	Antigen	Non-allergen	Non-toxin	Non-inducer		
	IGYGDGSSSHGTL	0.7310	Antigen	Non-allergen	Non-toxin	Inducer	Non-inducer	
	KTNEAAGDYDNVPV	0.3815	Non-antigen					
	LKQDGNGNS	1.1844	Antigen	Allergen				
>XP_002422286.1	TPKAFTPVTNGQEGKTSKRQA	1.1864	Antigen	Non-allergen	Non-toxin	Inducer	Non-inducer	
	KIGYDGGSSSQGTLY	0.7588	Antigen	Non-allergen	Non-toxin	Non-inducer		
	YKTNEAGGDYDNVPV	0.1978	Non-antigen					
	ELTQDSGN	1.5772	Antigen	Non-allergen	Non-toxin	Non-inducer		
>XP_002419429.1	PTTSKSKNSP	0.1599	Non-antigen					

	NVTGQ QGNGK VTH	2.42 19	Antigen	Non- allerge n	Non- toxin	Non- induc er		
	DITVGS NNQ	1.58 18	Antigen	Non- allerge n	Non- toxin	Induc er	Non- induce r	
	SIEYGD GTTSQG TWYK	- 0.02 87	Non- antigen					
	FADVTS TSV	- 0.09 70	Non- antigen					
	QSHEAE GYYDN	- 0.52 99	Non- antigen					
>XP_0 024210 72.1	TPVDQN DPTVRA K	1.14 67	Antigen	Allerg en				
	TGFPVD DTGRN DVVKR	- 0.33 37	Non- antigen					
	QKNEAT ESMY	0.61 64	Antigen	Allerg en				
	YTNGEP YPKC	- 2.58 67	Non- antigen					
	VKYTSQ SDVVP	0.75 60	Antigen					
>XP_0 024191 85.1	AIPEDID KR	0.85 44	Antigen	Non- allerge n	Non- toxin	Induc er	Induce r	No
	LINEGPS YAAT	- 1.10 39	Non- antigen					
	QYEDGS SSQGT VYK	0.29 55	Non- antigen					
	TGDETN PTYDNP V	0.17 27	Non- antigen					

	TTVSAST TPVLDS G	0.22 05	Non- antigen					
>XP_0 024193 06.1	APSSKR HERSFG HG	0.91 03	Antigen	Allerg en				
	LYQPSK TIETDEE KDSSDK	0.59 36	Antigen	Non- allerge n	Non- toxin	Induc er	Induce r	Yes
	TEGPGA YST	1.48 44	Antigen	Allerg en				
	LEVTSQ YGHT	1.03 57	Antigen	Non- allerge n	Non- toxin	Non- induc er		
	IDVEGSS GSTTN	2.92 57	Antigen	Non- allerge n	Non- toxin	Induc er	Non- induce r	
>XP_0 024200 70.1	TPSKYT KRDA	0.50 68	Antigen	Non- allerge n	Non- toxin	Induc er	Non- induce r	
	EIGSNK DKVSVSI DTG	1.94 89	Antigen	Non- allerge n	Non- toxin	Non- induc er		
	FQTEGA PQLPD	- 1.18 36	Non- antigen					
	VDGSAA QGVWG Y	2.14 74	Antigen	Non- allerge n	Non- toxin	Induc er	Induce r	No
	LETKDG KVTSG	2.74 50	Antigen	Allerg en				
	NATYD DNESV	- 0.46 21	Non- antigen					
	VAYTKD EDI	1.83 38	Antigen	Allerg en				



**Supplementary Table S4. Physiochemical properties of vaccine candidate.**

Number of amino acids	447
Molecular weight	45800.85
Antigenicity	Antigenic (Vaxijen score: 1.0662)
Allergic potential	Non-allergen
Theoretical pI	9.38
Instability index	38.93 (stable)
Total number of atoms	6419
Aliphatic index	83.56
Extinction coefficient	48930
Grand average of hydropathicity (GRAVY)	-0.172
Estimated half-life	30 hours (mammalian reticulocytes, in vitro). >20 hours (yeast, in vivo). >10 hours ( <i>Escherichia coli</i> , in vivo).