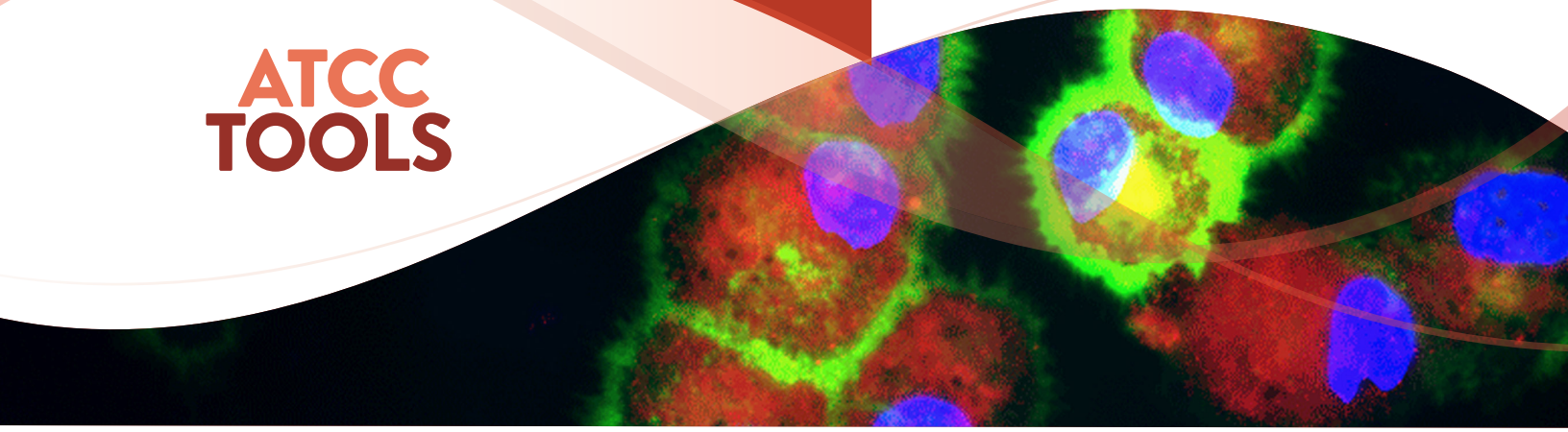
ATCC

ATCC TOOLS



IMMUNO-ONCOLOGY RESEARCH TOOLS

Cancer immunotherapy has emerged as an exciting new approach for cancer treatment, and immuno-oncology is one of the fastest growing fields in oncology. The development of immunomodulatory drugs and biologics dictate a clear need for human cell-based models to evaluate immune activation. To answer this need, ATCC provides a large collection of fully characterized and authenticated cell lines, human primary cells, and advanced cell models.

PRIMARY HUMAN IMMUNE CELLS

ATCC primary immune cells are able to support complex, physiologically relevant research projects, including:

- Cancer immunology studies
- Toxicity screening
- Transplantation and graft rejection
- Inflammation and allergy
- Vaccine and drug development

ATCC scientists have conducted in-depth authentication and quality control analyses on each of the primary immune cell types. In addition, the utility of these cells for scientific studies has been confirmed by ATCC R&D scientists. For example, the differentiation capacity of the bone marrow CD34+ cells and the peripheral blood CD14+ monocytes was characterized. Additionally, to confirm their immune activity the peripheral blood CD56+ natural killer cells were utilized as the effector cells in an NK activity assay.

CONTINUOUS CELL LINES

ATCC houses a vast collection of cell lines derived from various normal and diseased tissues from multiple species, representing a variety of immunological cells. ATCC routinely authenticates its cell lines using the following methods:

- Short tandem repeat (STR) profiling, to establish a DNA fingerprint
- Cellular morphology, which is monitored for consistency
- Cytochrome C Oxidase I (COI) Assay, for species determination
- PCR testing, for mycoplasma detection

ATCC offers many cells and other products for cancer immunology research. To see ATCC's complete cancer immunology offering, please visit www.atcc.org/cancerimmunology.

THP-1 REPORTER CELLS

ATCC introduced luciferase reporters containing the response element of immunologically important transcription factors into the THP-1 cell line. This advanced model provides a robust and highly sensitive means to measure immune activation through in vitro bioluminescence measurements.

To learn more about these advanced models please visit www.atcc.org/advancedimmunology.

CHECKPOINT MOLECULE PROFILING IN TUMOR AND IMMUNE CELLS AND APPLICATION FOR IMMUNO-ONCOLOGY DRUG SCREENING

Although immune checkpoint blockades have exhibited anti-tumor effects in multiple cancer types, there are still challenges to overcome such as resistance and low response rate. Thus, there is a need for comprehensive data on the expression levels of checkpoint molecules based on cancer type, which can be utilized to guide specific treatment plans and combinations.

ATCC has complied a comprehensive data set of checkpoint molecule expression levels on a variety of tumor and immune cell lines and primary T cells. The cells that were tested demonstrate high expression levels of both checkpoint inhibitory and co-stimulatory molecules. These established cell lines can be incorporated into simple blocking assays or be integrated into co-culture testing systems. Additionally, this information provides a relevant and accessible model system for studying checkpoint molecule interactions and screening biologics as cancer immunotherapy treatments.

Table 1: Checkpoint molecule expression levels of immune cell receptors

		HLA typing		Inhibitory checkpoint molecules						
Cell Lines	ATCC® No.	HLA class I	HLA class II	PD-1	CTLA4	LAG-3	TIM-3	BTLA	VISTA	TIGIT
Jurkat E6-1	TIB-152™	+	-	45	0	71	43	202	2406	17
TALL-104	CRL-11386™	+	-	75	2	159	1090	301	1051	0
MOLT-3	CRL-1552™	+	-	230	71	107	42	191	377	32
HH	CRL-2105™	+	+	243	24	1046	749	606	3878	1995
HuT 78	TIB-161™	+	+	231	20	416	267	1114	2884	88
SUP-T1	CRL-1942™	+	-	2076	219	81	20	487	1339	18
HM2	HB-8587™	+	-	361	46	120	0	464	4075	221
MJ [G11]	CRL-8294™	+	+	272	91	348	281	2740	1607	4727
CCRF-CEM	CCL-119™	+	-	108	13	81	111	222	119	53
Primary CD8+ T cells	PCS-800-017™	+	-	812	98	274	10745	623	1378	88
Primary CD4+ T cells	PCS-800-016™	+	-	921	106	35	1381	756	1029	32

Median Max

The expression levels of established and novel inhibitory check point molecule receptors were profiled on basal immune cell lines available at ATCC by FACS analysis. HLA typing is identified by low expression (-) and high expression (+). Conditional formatting is added to the table to compare the expression of checkpoint molecules between cell lines (compare within each column). The value is calculated by subtracting the median fluorescence intensity (MFI) of the sample by the MFI of the isotype control.

Table 2: Checkpoint molecule expression levels of immune cell receptors

		HLA typing		Co-stimulatory checkpoint molecules							Immune cell marker	
Cell Lines	ATCC® No.	4-1BB	ICOS	CD30	CD28	OX40	GITR	CD226	CD4	CD8	CD4	CD8
Jurkat E6-1	TIB-152™	+	-	0	77	3463	0	0	156	11054	275	14
TALL-104	CRL-11386™	+	-	30	501	36	14507	319	243	99	58	85358
MOLT-3	CRL-1552™	+	-	0	929	672	4353	273	303	149	143	617
HH	CRL-2105™	+	+	42	68	214676	512	1368	610	26814	29347	121
HuT 78	TIB-161™	+	+	240	1014	13216	431	3661	9674	901	7852	397
SUP-T1	CRL-1942™	+	-	0	54	1	15430	876	32	656	29250	81122
HM2	HB-8587™	+	-	0	518	531	56	854	322	736	229	5412
MJ [G11]	CRL-8294™	+	+	501	9072	51092	0	15528	37952	2987	21023	101
CCRF-CEM	CCL-119™	+	-	7	347	567	5884	163	479	342	9641	6306
Primary CD8+ T cells	PCS-800-017™	+	-	57	1567	71	607	119	720	4268	0	223247
Primary CD4+ T cells	PCS-800-016™	+	-	43	2252	862	6477	380	1040	5041	7916	21

Median Max

The expression levels of established and novel co-stimulatory check point molecule receptors were profiled on basal immune cell lines available at ATCC by FACS analysis. HLA typing is identified by low expression (-) and high expression (+). Conditional formatting is added to the table to compare the expression of checkpoint molecules between cell lines (compare within each column). The value is calculated by subtracting the median fluorescence intensity (MFI) of the sample by the MFI of the isotype control.

Table 3: Checkpoint molecule expression levels of tumor cell ligands

"-": without IFNγ
"+": with IFNγ

Cancer type	Cell lines	ATCC® No.	HLA typing		Inhibitory checkpoint molecule ligands									
			HLA class I	HLA class II	PD-L1 -	PD-L1 +	PD-L2 -	PD-L2 +	B7-H3 -	B7-H3 +	B7-H4 -	B7-H4 +	HVEM -	HVEM +
Bladder	5637	HTB-9™	+	-	52096	143325	49	2594	60004	52945	0	0	1593	1783
	HT-1197	CRL-1473™	+	-	40740	45360.5	1368	6891.5	21853	16451	0	0	1785	2838
	HT-1376	CRL-1472™	+	-	27135	51493	1692	8578	74667.5	66185	0	0	365	1790
	RT4	HTB-2™	+	-	0	5054	52	518	143148	139442	0	42	717	1602
	TCCSUP	HTB-5™	-	+	30543	48394	4325	9664	131058	123270	930	822	526	1422
Brain	SK-N-BE(2)	CRL-2271™	+	-	245	6837	0	258	15903	17884	156	123	262	237
	U-87 MG	HTB-14™	+	-	321	2990	249	246	73474	72722	338	263	4718	3312
	U-87 MG-Luc2	HTB-14-LUC2™	+	-	15061	40367	0	0	29967	29009	1508	1374	487	706
Breast	AU565	CRL-2351™	+	-	2428	11013	0	0	9476	8169	3514	2925	307	831
	BT-20	HTB-19™	+	-	6082	17072	886	4614	44830	44507	711	761	0	0
	DU4475	HTB-123™	+	-	1912	3232	1082	3774	59238	54996	1941	1317	4014	4293
	HCC38	CRL-2314™	+	-	13009	126059	3097	16705	220234	208819	2300	1565	6396	7267
	MCF7	HTB-22™	+	-	53	1802	0	0	46613	42793	4324	2944	2197	1972
	MCF7-Luc2	HTB-22-LUC2™	+	-	0	3116	0	2793	56518	53829	575	936	1331	1723
	MDA-MB-231	HTB-26™	+	-	11359	20492	986	1880	12979	11668	149	125	456	1031
	MDA-MB-468	HTB-132™	+	-	221	5046	115	380	16180	16342	806	575	140	438
	T-47D	HTB-133™	+	-	72	6355	0	0	32581	24851	828	594	597	703
Bone	HOS	CRL-1543™	-	+	13031	41473	2927	9075	60530	61277	289	305	211	552
	MG-63	CRL-1427™	-	+	0	7362	0	0	84745	79181	443	819	368	730
	Saos-2	HTB-85™	+	-	6082	32705	0	0	7455	7136	332	329	897	1244
	U-2 OS	HTB-96™	+	-	5929	36019	290	5915	63080	64082	548	333	830	1152
Colon	Caco-2 [Caco2]	HTB-37™	+	-	0	471	0	0	32201	30175	1315	1209	1900	1817
	HCT-15	CCL-225™	-	+	474	3790	35	0	12896	12520	137	94	513	947
	LoVo	CCL-229™	-	+	468	17697	0	0	20338	19572	347	346	975	2481
Head & Neck	A-253	HTB-41™	+	-	2070	16019	123	3176	43926	41341	18	0	45	477
	FaDu	HTB-43™	+	-	2733	37007	205	13372	39475	31090	0	0	138	855
	FaDu-Luc2	HTB-43-LUC2™	+	-	6965	29601	0	0	24921	20048	269	333	421	448
Liver	C3A [HepG2/C3A]	CRL-10741™	+	-	0	2114	0	2698	18098	16938	441	453	1362	2682
	SK-HEP-1	HTB-52™	+	+	657	8371	1201	8770	13236	13610	283	599	642	1096
Lung	A549	CCL-185™	+	-	1512	9611	0	2476	34719	33139	0	0	764	752
	Calu-1	HTB-54™	+	-	53834	114947	3528	10080	18438	19072	588	604	921	2119
	NCI-H1650 [H-1650, H1650]	CRL-5883™	+	-	3491	15369	1050	5615	127539	134041	1738	1422	263	476
	NCI-H226 [H226]	CRL-5826™	-	+	49391	145367	10744	24379	73920	101793	640	767	0	672
	NCI-H441 [H441]	HTB-174™	+	-	13424	34487	359	1782	34363	32832	887	1044	383	829
	NCI-H460 [H460]	HTB-177™	+	-	7193	19574	921	2778	55359	49738	885	1089	0	742
	HCC827	CRL-2868™	+	-	9795	60468	3725	8477	41249	47178	1817	1721	879	0
	NCI-H1299	CRL-5803™	+	-	278	3436.5	0	92	37817	36030	0	0	0	0
	NCI-H1975 [H-1975, H1975]	CRL-5908™	+	-	2483	23447	490	4677	70851	62007	0	0	368	1729
	NCI-H596 [H596]	HTB-178™	+	-	18669	40780	1275	3245	84320	77592	0	0	0	275
Melanoma	A-375 [A375]	CRL-1619™	+	-	1255	27782	0	433	52580	40341	0	0	566	1127
	A375-KRAS	CRL-1619IG-1™	+	-	40740	45361	1368	6891.5	21853	16451	0	0	1785	2838
	A375-KRAS-Luc2	CRL-1619IG-1-LUC2™	+	-	109294	117180	0	966	12826	13191	735	816	0	60
	RPMI-7951	HTB-66™	+	-	10229	26724	2662	8763	65180	80081	0	0	523	1646
	SH-4	CRL-7724™	+	-	1291	12124	0	0	54016	44759	0	68	2556	3350
	SK-MEL-24	HTB-71™	-	+	400	17538	1000.5	750	26932	17137	27	60	236	1187
Ovarian	ES-2	CRL-1978™	+	-	57764	89033	718	5906	11970	11255	405	390	1161	1368
Pancreas	AsPC-1	CRL-1682™	-	+	0	6325	155	2800	28044	26743	297	397	1147	2666
	PANC-1	CRL-1469™	+	-	1049	0	0	0	20419	21694	421	473	1276	976
	PANC 10.05	CRL-2547™	+	-	27818	43052	1359	4174	15027	17384	0	0	996	1402
Prostate	PC-3	CRL-1435™	-	+	18303	47222	346	2725	31886	29497	641	230	203	1704
	PC-3-Luc2	CRL-1435-LUC2™	+	-	20083	30374	0	0	18686	19516	411	497	823	1387
Skin	A-431	CRL-1555™	+	-	13020	37809	1660	6635	64875	61082	996	1792	2656	5120
	A-431-Luc2	CRL-1555-LUC2™	+	-	2868	41277	688	3235	14291	12967	458	463	446	1021
Uterine	HEC-1-A	HTB-112™	+	-	0	0	0	0	23302	21501	337	373	418	449

The expression levels of established and novel checkpoint inhibitory molecule ligands were profiled on basal (-) and 100 ng/mL IFNγ-stimulated (+) tumor cell lines available at ATCC were profiled by FACS analysis. HLA typing is identified by low expression (-) and high expression (+). Conditional formatting is added to the table to compare the expression of checkpoint molecules between cell lines (compare within each column). The value is calculated by subtracting the median fluorescence intensity (MFI) of the sample by the MFI of the control isotype.

Table 4: Checkpoint molecule expression levels of tumor cell ligands.

"-": without IFNγ
"+": with IFNγ

Cancer type	Cell lines	ATCC® No.	HLA typing: HLA class I	HLA typing: HLA class II	Co-stimulatory checkpoint molecule ligands: 4-1BBL -	4-1BBL +	ICOS-L -	ICOS-L +	CD155 -	CD155 +	CD80 -	CD80 +	CD86 -	CD86 +
Bladder	5637	HTB-9™	+	-	3085	2831	1322	1464	68780	85293	2092	3069	1909	1993
	HT-1197	CRL-1473™	+	-	0	1852	1682	1837	105114	127213	4220	6126	2120	2878
	HT-1376	CRL-1472™	+	-	0	0	3440	6322	36478	44828	4293	4179	1233	1707
	RT4	HTB-2™	+	-	2395	2961.5	5676	7754	40953	48452	883	1097	1482	1954
	TCCSUP	HTB-5™	-	+	3016	3758	315	366	271088	282653	3912	3573	3917	3933
Brain	SK-N-BE(2)	CRL-2271™	+	-	626	528	228	240	5236	6395	452	350	923	778
	U-87 MG	HTB-14™	+	-	2804	3010	339	454	30877	33809	2926	2597	2080	1968
	U-87 MG-Luc2	HTB-14-LUC2™	+	-	1717	1370	141	219	36063	43417	1851	1491	984	753
Breast	AU565	CRL-2351™	+	-	1289	841	633	856	37017	35953	983	1027	433	454
	BT-20	HTB-19™	+	-	7297	8831	300	136	203815	235198	8916	9398	1172	1244
	DU4475	HTB-123™	+	-	8298	6525	0	0	36382	32343	8865	6426	2523	1278
	HCC38	CRL-2314™	+	-	1912	3050	1525	1855	132767	134741	5751	4437	2143	1906
	MCF7	HTB-22™	+	-	4821	4165	1583	2402	23280	22977	5720	4584	2867	2424
	MCF7-Luc2	HTB-22-LUC2™	+	-	3902	5935	465	1037	20258	22678	1724	5297	1215	2149
	MDA-MB-231	HTB-26™	+	-	531	777	14	37	38583	53188	563	428	346	234
	MDA-MB-468	HTB-132™	+	-	740	769	401	747	36560	43422	475	464	308	290
	T-47D	HTB-133™	+	-	3140	1990	859	683	39364	37651	3038	2166	1620	1325
Bone	HOS	CRL-1543™	-	+	1127	1210	0	0	99713	124829	841	815	443	400
	MG-63	CRL-1427™	-	+	4326	4901	0	0	303805	268365	2894	6552	1339	2968
	Saos-2	HTB-85™	+	-	2525	1975	0	0	58992	70813	1726	1733	1644	1525
	U-2 OS	HTB-96™	+	-	2321	2660	784	778	112962	124648	2554	1174	3008	3045
Colon	Caco-2 [Caco2]	HTB-37™	+	-	4255	5817	1060	661	44423	39942	6756	4849	4146	3170
	HCT-15	CCL-225™	-	+	369	251	0	21	33045	34475	411	140	441	335
	LoVo	CCL-229™	-	+	1581	1647	775	1080	24870	36144	903	1271	1044	1010
Head & Neck	A-253	HTB-41™	+	-	1431	2558	3380	3887	67935	83057	3303	3051	731	985
	FaDu	HTB-43™	+	-	1640	0	3643	4161	60462	62858	2728	2720	1904	1951
	FaDu-Luc2	HTB-43-LUC2™	+	-	1159	1591	484	557	35527	40460	1019	1334	2147	2183
Liver	C3A [HepG2/C3A]	CRL-10741™	+	-	1243	2171	394	511	54751	59271	1729	1914	1136	1100
	SK-HEP-1	HTB-52™	+	+	3066	2824	156	271	61906	75802	449	3240	383	1339
Lung	A549	CCL-185™	+	-	943	1345	2547	3209	87047	88786	719	1227	810	1078
	Calu-1	HTB-54™	+	-	2993	3444	0	0	94510	114947	3240	3268	1210	1254
	NCI-H1650 [H-1650, H1650]	CRL-5883™	+	-	8605	9501	0	0	353964	391949	9642	7584	1455	916
	NCI-H226 [H226]	CRL-5826™	-	+	2378	2758	3006	2629	136158	229665	2143	2477	1202	897
	NCI-H441 [H441]	HTB-174™	+	-	2762	2540	246	260	59151	73580	2841	3133	3440	3250
	NCI-H460 [H460]	HTB-177™	+	-	2375	3040	189	615	78046	86814	2342	3040	3792	3223
	HCC827	CRL-2868™	+	-	3726	3399	162	0	58497	105562	5176	7123	2222	1917
	NCI-H1299	CRL-5803™	+	-	2768	3391	2961	4373	196936	184904	3765	3790	909	662
	NCI-H1975 [H-1975, H1975]	CRL-5908™	+	-	227	208	535	1455	168919	175547	3665	4409	1160	1412
	NCI-H596 [H596]	HTB-178™	+	-	0	0	3410.6	3890	255616	311989	5243	2880	1349	1078
Melanoma	A-375 [A375]	CRL-1619™	+	-	0	0	755	544	30126	37903	3133	2863	1237	1077
	A375-KRAS	CRL-1619IG-1™	+	-	0	1852	1682	1837	105114	127213	4220	6126	2120	2878
	A375-KRAS-Luc2	CRL-1619IG-1-LUC2™	+	-	3526	3450	0	0	128469	160467	4777	5130	1723	1784
	RPMI-7951	HTB-66™	+	-	0	0	1930	1297	66083	91229	883	1097	1482	1954
	SH-4	CRL-7724™	+	-	108	2006	1142	760	66235	65168	3429	4481	932	1507
	SK-MEL-24	HTB-71™	-	+	2903	3177	6613	5316	45197	75332	888	826	2945	2605
Ovarian	ES-2	CRL-1978™	+	-	2730	1971	188	0	92087	122142	1453	1620	3210	3510
Pancreas	AsPC-1	CRL-1682™	-	+	1415	1444	310	546	32180	49052	825	1290	3033	3095
	PANC-1	CRL-1469™	+	-	2031	2093	331	196	33618	34518	2265	2625	2005	1878
	PANC 10.05	CRL-2547™	+	-	1802	3716	847	857	40464	48360	2628	4485	1485	2323
Prostate	PC-3	CRL-1435™	-	+	5474	2108	0	0	91370	122713	2503	0	555	0
	PC-3-Luc2	CRL-1435-LUC2™	+	-	2871	2989	217	0	57153	83352	1924	2850	3223	3412
Skin	A-431	CRL-1555™	+	-	2623	4203	1369	1757	130495	152286	2297	2824	1078	893
	A-431-Luc2	CRL-1555-LUC2™	+	-	845	942	0	10	39458	41452	618	709	528	573
Uterine	HEC-1-A	HTB-112™	+	-	1401	1471	199	136	46400	41305	2300	1860	628	722

Median — Max

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ADDITIONAL IMMUNO-ONCOLOGY RESOURCES

- Ap Note: A Simple and Rapid Alternative to 51Chromium or Fluorescent Dye Loading for Quantification of Natural Killer Cell Activity: ATCC® K-562-GFP™ Cells
- Ap Note: Differentiation and Expansion of Hematopoietic Precursor Cells from Bone Marrow-Derived CD34+ Progenitors
- Ap note: In Vitro Differentiation of Macrophages and Dendritic Cells from Primary Human CD14+ Monocytes
- Webinar: Discovering ATCC Hematopoietic Progenitor Cells – Model Systems to Study the Immune and Cardiovascular Systems
- Webinar: Illuminate Immuno-oncology Research with THP-1 Luciferase Reporter Cell Lines
- Poster: Checkpoint Molecule Profiling in Tumor Cell Lines and Immune Cell Lines for Applications in Immuno-oncology Drug Screening
- Poster: Primary NK Cells and Luciferase Expressing Reporter Cell Lines for Use in Developing ADCC Assays for Immuno-oncology Drug
- Cancer Immunology Brochure

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