

Table 2. Human cytomegalovirus (HCMV) mutant collection

ORF*	Position	Mutant	Virus growth[†]
Int RL2-RL3	2850	TN-335	+
	2684	TN-607	ND
	2550	TN-661	ND
Int RL3-RL4	3615	TN-558	+
RL4	3996	TN-117	+
Int RL4-RL6	4461	TN-351	ND
	4554	TN-403	+
	4935	TN-154	+
	4985	TN-595	ND
RL6	5847	TN-155	+
	5690	TS-26	ND
	5670	TN-172	+
Int RL6-RL8	6449	TN-462	+
	6316	TN-596	ND
	6197	TN-561	ND
	6788	TN-2	+
	6745	TN-503	ND
RL8	7528	TS-160	+
Int RL9-RL10	8081	TN-386	+
RL11	8992	TS-57	+
	8736	TN-152	+
RL12	10203	TN-133	+
	10244	TN-388	+
	9758	TN-542	ND
RL13	10925	TN-676	ND
	11235	TN-683	ND
TRL14	11350	TN-466	ND

ORF*	Position	Mutant	Virus growth[†]
	11585	TN-458	ND
J1L/J1S	189018	TS-365	+
UL1	12141	TS-433	+
UL5	14018	TN-424	+
Int UL5-UL6	14530	TS-350	ND
	14565	TS-414	ND
UL9	16690	TS-397	ND
	16615	TN-632	+
	17017	TS-410	ND
	16668	TN-666	+
UL11	18490	TN-406	+
UL13	19872	TS-235	+
UL14	20863	TS-425	+
UL16	22893	TN-584	+
UL18	24612	TN-385	+
UL20	25839	TS-382	+
UL21a	26626	TS-101	+
	26696-26842	DH-52	+
UL23	28101	TS-269	+
	28372	TS-435	+
UL24	29595	TS-257	+
	29234	TS-219	+
	29987	TS-195	+
UL25	31051	TN-433	+
UL26	32260-32746	DH-1	+
	32608-32639	DH-76	+
UL27	34360	TS-28	+
	33373	TN-130	+
	33349	TN-377	+

ORF*	Position	Mutant	Virus growth[†]
UL28	35138	TS-318	+
	35568-35780	DH-54	+
Int UL28-UL29	35909	TS-81	+
UL29	36662	TS-139	+
	36866-36896	DH-56	+
UL30	37369-37400	DH-32	+
UL31	38502-38603	DH-3	+
UL32	42665	TN-553	-
UL33	43460	TS-73	+
	43986	TS-322	+
UL34	45188	TS-194	-
	44791-44857	DH58	-
UL35	46145-47971	DH-5	+
	46366-46490	DH-66	+
UL36ex2	48722	TS-173	+
UL37ex3	50068	TS-240	ND
UL37ex3	50752	TS-224	ND
UL37ex1	52698-53091	DH-72	-
Int UL37ex1-UL38	52179	TS-404	ND
UL38	51331	TN-4	+
	51131-52126	DH-100	+
Int UL37ex1-UL39	52712	TS-201	+
UL41a/UL41	54143	TS-440	+
UL42	54614+86 [‡]	TS-75	+
UL44	55839	TN-309	-
	55982	TN-413	-
UL45	57232	TN-157	+
UL46	59823	TS-403	-
UL47	61761	TN-592	+

ORF*	Position	Mutant	Virus growth[†]
UL48	65978	TS-31	ND
	64165	TN-605	+
	68662	TS-108	ND
	63917	TN-656	+
	67243	TS-215	ND
	69456	TS-209	ND
	70028	TS-409	ND
	66333	TS-357	ND
	65978	TS-393	ND
	65835	TS-431	ND
UL48.5	70346	TS-141	-
UL49	71412	TS-177	-
	70658	TS-200	-
	71744	TS-353	-
	71051	TS-421	-
UL50	72376	TN-611	-
	72946	TS-230	-
	72886	TS-392	-
UL51	73343	TS-168	-
UL52	75624	TS-84	ND
	75206	TS-170	ND
	74965	TS-189	-
	75000	TS-325	ND
	74547	TS-355	-
UL53	76432	TN-131	-
	76371	TS-258	ND
	76239	TS-367	ND
UL54	78300	TS-3	ND
	78776	TN-372	-

ORF*	Position	Mutant	Virus growth[†]
	77835	TS-7	ND
	79998	TS-16	ND
	78180	TS-274	ND
Int UL54-UL55	80664	TS-198	ND
UL55	81601	TS-92	ND
	81815	TN-564	–
	83021	TS-310	–
	82541	TS-423	ND
UL56	85868	TS-22	ND
	84734	TN-461	–
	84583	TS-222	ND
	84536	TS-211	ND
	83713	TS-202	ND
	84770	TS-326	ND
	84098	TS-339	ND
	83887	TS-342	ND
	85909	TS-358	ND
	85310	TS-364	ND
	84858	TS-33	ND
	83737	TN-557	–
	84636	TS-53	ND
	84170	TS-88	ND
	84806	TS-132	ND
	83743	TS-260	ND
	85736	TS-152	ND
	85422	TS-179	ND
	84642	TS-228	ND
Int UL56-UL57	86417	TS-164	ND
	86340	TS-180	ND

ORF*	Position	Mutant	Virus growth[†]
	86466	TS-227	ND
UL57	88772	TS-107	ND
	88834	TS-298	ND
	88853	TS-296	ND
	88931	TS-206	-
	89476	TS-402	-
	88130	TS-424	ND
Int UL57-UL60	90606	TN-602	+
	92302	TS-192	-
	92037	TS-373	-
	91209	TS-237	+
	91329	TS-277	+
	91256	TS-428	+
UL60	92405	TS-388	-
UL61	93220	TN-148	-
	92848	TS-309	-
Int UL61-UL65	95152	TN-587	+
	95841	TN-636	+
	96219	TN-621	+
	94697	TN-658	+
	95536	TN-183	+
	95916	TN-125	+
	96192	TS-1	+
	96124	TS-217	+
	96161	TS-439	ND
UL65	96316-96479	DH-36	+
Int UL65-UL69	97076	TS-41	ND
	96777	TS-305	+
	97114	TS-241	+

ORF*	Position	Mutant	Virus growth[†]
	97600	TS-56	+
	97915	TS-266	+
UL69	99215	TS-138	ND
	99544	TS-158	+
Int UL69-UL70	100478	TS-332	ND
UL70	100690	TS-48	-
	100598	TS-79	-
UL71	103867	TS-145	+
	103891	TS-147	+
Int UL71-UL72	104550	TS-129	ND
UL72	104645	TS-42	+
	104782	TS-87	ND
	105480	TS-291	ND
	104759	TS-212	ND
	105358	TS-188	+
	105294	TS-340	+
UL73	105923	TS-186	-
	105974-106038	DH-74	-
UL74	106626	TS-348	ND
	107109	TN-153	+
	106257	TN-375	+
	106381	TS-383	ND
Int UL74-UL75	107753	TS-149	ND
UL75	109167	TS-109	-
	109624	TN-120	-
	109898	TS-196	ND
	109864	TS-384	ND
Int UL75-UL76	110269	TS-61	ND
UL76	110832	TS-238	+

ORF*	Position	Mutant	Virus growth[†]
UL77	111110	TS-293	-
	111817	TS-111	-
	112039	TS-411	-
UL78	113804	TS-97	+
	114135	TS-125	ND
	114011	TS-123	ND
	113432	TS-166	+
	113941	TS-344	ND
	113498	TS-360	ND
	113935	TS-381	ND
UL79	114307	TS-259	ND
	114597	TS-225	-
	114407	TS-313	ND
	114301	TS-199	ND
	114885	TS-197	-
	114461	TS-363	ND
UL80	115482	TS-76	-
UL80	115511	TS-302	-
UL80/UL80a	116225	TS-208	-
UL82	118693	TS-60	+
UL83	119482	TS-80	+
	120623	TS-436	+
UL84	121720	TS-27	ND
	122829	TS-175	-
	122419	TS-205	-
	121719	TS-184	ND
	122348	TS-335	ND
	121456	TS-351	ND
	122036	TS-366	ND

ORF*	Position	Mutant	Virus growth[†]
UL85	123381	TS-119	-
	123207	TS-362	-
Int UL85-UL86	124067	TS-223	ND
UL86	127216	TS-15	ND
	125741	TN-486	-
	124944	TS-25	ND
	125349	TN-512	-
	126912	TS-236	ND
	124301	TS-333	ND
	125948	TS-376	ND
	125121	TS-407	ND
	124653	TS-419	ND
	127397	TS-426	ND
	128263	TS-429	ND
UL87	129019	TS-63	ND
	130300	TS-255	ND
	130595	TS-226	ND
	130523	TS-361	ND
	130715	TS-422	ND
	128699	TS-430	ND
	130813	TS-118	ND
	129657	TS-122	-
	129882	TS-220	-
	129906	TS-144	ND
	130407	TS-146	ND
	129911	TS-317	ND
	129929	TS-314	ND
	130041	TS-285	ND
UL88	131675	TS-182	+

ORF*	Position	Mutant	Virus growth[†]
	131981	TS-210	ND
	132197	TS-187	ND
	132210	TS-343	ND
	131710	TS-432	+
UL89ex1	137636	TN-142	-
UL89ex2	133118	TS-374	-
UL91	133888	TS-19	-
	133848-133863	DH60	-
UL92	134548	TS-18	ND
	134727	TS-133	ND
	134641	TS-178	ND
	134406	TS-321	ND
	134531	TS-324	ND
	134210	TS-347	-
	134193	TS-356	-
	134204	TS-377	ND
	134674	TS-386	ND
UL93	134779	TS-34	-
	135919	TS-43	ND
	134841	TS-44	-
	135649	TS-148	ND
	134781	TS-162	ND
	135169	TS-385	-
	135784	TS-399	ND
UL94	137217	TS-13	ND
	136930	TS-54	ND
	136848	TS-106	ND
	136593	TS-114	+
	136754	TS-256	+

ORF*	Position	Mutant	Virus growth[†]
	137202	TS-169	ND
	137386	TS-341	ND
	136650	TS-394	+
	137042	TS-398	ND
UL95	139444	TS-55	ND
	139394	TN-136	-
	138943	TS-121	-
	138654	TS-307	-
	139453	TS-248	ND
	139376	TS-331	ND
Int UL95-UL96	140005	TS-316	ND
UL96	140280	TS-59	ND
	140268	TS-143	ND
	140360	TS-151	ND
	140067	TS-154	+
	140182	TS-315	+
Int UL96-UL97	140368	TS-292	ND
	140446	TS-400	ND
UL97	142528	TS-95	ND
	141751	TS-140	ND
	142242	TS-284	ND
	140825	TS-253	+
	140948	TS-185	+
	141836	TS-389	ND
	141859	TS-396	ND
UL98	142723	TS-46	-
	143720	TN-631	-
	142839	TS-127	-
	144135	TS-352	ND

ORF*	Position	Mutant	Virus growth[†]
UL99	144775	TS-112	+
	144537	TN-137	-
Int UL99-UL100	145004	TS-38	ND
	145189	TS-207	ND
UL100	146320	TS-416	-
UL102	146992	TS-89	-
	148532	TS-156	-
	148602	TS-172	ND
	148692	TS-304	ND
Int UL102-UL103	149240	TS-190	ND
	149237	TS-327	ND
UL103	149320	TS-288	+
	149828-149929	DH-7	+
	149717-149759	DH68	+
UL104	151432	TS-20	ND
	150132	TS-4	ND
	151356	TS-64	-
	151117	TS-113	-
	150388	TS-134	ND
	151730	TS-216	ND
	151649	TS-286	ND
UL105	154597	TS-17	ND
	152821	TS-157	ND
	153516	TS-319	ND
	152764	TS-380	ND
	154266	TN-414	-
Int UL105-UL111a	157476	TS-278	ND
	156887	TN-641	ND
	156737	TN-111	ND

ORF*	Position	Mutant	Virus growth[†]
	156728	TN-464	ND
	158783	TS-58	ND
	158751	TS-379	ND
	158822	TS-174	ND
	158756	TS-246	ND
	158917	TS-242	ND
	158720	TS-336	ND
	159541	TS-149	+
	158340	TN-439	+
	155531	TN-140	ND
	156017	TN-379	ND
	157634	TN-171	ND
	157756	TS-181	ND
	158178	TN-541	ND
	158028	TS-176	ND
	158167	TS-378	ND
UL111a	159730	TS-359	+
	160030	TS-9	+
	159991	TS-337	ND
Int UL111a-UL112	160142	TS-50	ND
	160172	TS-270	ND
UL112/113ex1	160832	TS-234	+
UL112/113ex2	161691-161748	DH62	+
UL114	163493-163594	DH-9	+
UL115	164419-164421	DH-110	-
UL116	165263-165313	DH-11	+
UL117	166495	TN-635	+
UL118/119	167273	TS-103	+
	167397	TS-193	+

ORF*	Position	Mutant	Virus growth[†]
UL121	168888	TS-72	+
	168803	TS-391	+
UL122	169444	TS-434	+
UL123ex4	172058	TN-324	-
Int UL126-UL127	174063	TN-566	+
	174174	TN-576	+
UL128-new	174896	TN-328	+
	175595	TS-264	+
Int J1L-IRS1	189586	TN-452	+
Us10	199561	TN-353	+
Int Us11-Us12	200390	TN-520	+
Us14	202333	TN-331	+
Us15	203620	TN-460	+
Us16	204664-205080	DH-12	+
Us17	206104	TN-134	+
	205845-206106	DH-38	+
Us18	206740-207198	DH-14	+
Us19	207357	TN-516	+
	207708-208018	DH-16	+
Us20	208546-208924	DH-18	+
	208665-298870	DH-78	+
Us21	209606-309645	DH-20	+
Us22	210759	TS-14	+
	210852	TN-594	+
Us23	212967-213419	DH-22	+
	212763-212805	DH-70	+
Us24	213931	TN-568	+
	214655-214733	DH-64	+
Us25	215362-215585	DH-42	+

ORF*	Position	Mutant	Virus growth[†]
Us26	215941	TN-113	+
	216346-216665	DH-40	+
Int Us27-Us28	219091	TS-418	ND
Us29	220459-220878	DH-24	+
Us30	221894-221923	DH-26	+
Us31	222784-222854	DH-34	+
Us32	223418-223885	DH-28	+
Us34	224483-224920	DH-30	+
Us34a	225027-225162	DH-44	+

ND, not determined.

*Int, intergenic.

[†],+, virus produced; -, virus failed to be produced after eletroporation of HCMV– bacterial artificial chromosome DNA into human fibroblasts.

[‡]Transposon inserted in nucleotide 86 of the 929-bp viral region that is lost in the AD169-UK genome that was originally sequenced.