

**Table S3.** Genes expressed at significantly higher levels in the flea by the *Y. pseudotuberculosis* mutant (IPmt strain) than by wild-type *Y. pestis* CO92

Gene ID <sup>a</sup>	Gene name	Predicted gene function	Relative expression
<b>1 day after infection:</b>			
YPTB0024	YPO0024	<i>glnA</i> glutamine synthetase	2.2
YPTB0092	YPO0100	-- hypothetical protein	6.1
YPTB0093	YPO0101	-- hypothetical protein	4.3
YPTB0358	YPO0301	-- hypothetical protein	2.7
YPTB0546	YPO0406	-- hypothetical protein	2.6
YPTB0576	YPO0431	<i>osmY</i> periplasmic chaperone protein	19.1
YPTB0577	YPO0432	-- hypothetical protein	8.4
YPTB0578	YPO0433	<i>yjjU</i> hypothetical protein	2.1
YPTB0626	YPO0484	<i>yjjP</i> transmembrane protein	2.2
YPTB0639	YPO0498	-- Type VI secretion system locus 4 (T6SS-4) protein	14.8
YPTB0641	YPO0500	-- T6SS-4 protein TssB	8.1
YPTB0642	YPO0501	-- T6SS-4 EvpB family protein ImpC	8.4
YPTB0643	YPO0502	<i>hcp</i> T6SS-4 protein Hcp	24.1
YPTB0657	YPO0516	-- T6SS-4 hypothetical protein	10.7
YPTB0830	YPO3300	<i>luxS</i> S-ribosylhomocysteinase; autoinducer-2 synthesis	2.3
YPTB0841	YPO3286	<i>aroF</i> phospho-2-dehydro-3-deoxyheptonate aldolase	2.5
YPTB0910	YPO3216	-- methyltransferase	7.3
YPTB0973	YPO3143	<i>glnK</i> nitrogen regulatory protein P-II 2	2.3
YPTB0976	YPO3140	<i>ybaY</i> lipoprotein	2.1
YPTB0978	YPO3138	<i>ymoA</i> hemolysin expression-modulating protein	3.0
YPTB0979	YPO3137	-- hypothetical protein	2.7
YPTB0998	YPO3116	<i>ddhD</i> CDP-6-deoxy-delta-3,4-glucoseen reductase	2.6
YPTB1001	YPO3113	<i>ddhC</i> CDP-4-keto-6-deoxy-D-glucose-3-dehydratase	2.3
YPTB1002	YPO3112	<i>prt</i> paratose synthase	3.4
YPTB1003	YPO3111	<i>wbyH</i> hypothetical protein	3.5
YPTB1004	YPO3110	<i>wzx</i> O-unit flippase	4.7
YPTB1006	YPO3107	<i>wbyJ</i> mannosyltransferase	3.7
YPTB1008	YPO3104	<i>wbyK</i> mannosyltransferase	4.2
YPTB1011	YPO3099	<i>manC</i> mannose-1-phosphate guanylyltransferase	3.5
YPTB1012	YPO3098	<i>wbyL</i> glycosyltransferase	4.1
YPTB1013	YPO3097	<i>manB</i> phosphomannomutase	10.0
YPTB1014	YPO3096	<i>wzz</i> ferric enterobactin transport protein FepE	3.1
YPTB1052	YPO2806	-- aldo/keto reductase	3.1
YPTB1053	YPO2805	-- aldo/keto reductase	5.9
YPTB1086	YPO2593	-- LuxR family regulatory protein	3.7
YPTB1088	YPO2595	<i>cspE</i> cold shock protein	2.2
YPTB1167	YPO1134	<i>psiF</i> starvation-inducible protein	2.9

YPTB1222	YPO1181	--	membrane protein	5.0
YPTB1240	YPO1200	<i>adiC</i>	arginine:agmatin antiporter	2.7
YPTB1258	YPO1218	<i>rscB</i>	transcriptional regulator	2.5
YPTB1261	YPO1222	--	outer membrane porin protein C	5.0
YPTB1292	YPO3653	--	colicin immunity protein	2.0
YPTB1337	YPO1306	<i>nfo</i>	endonuclease IV	2.4
YPTB1338	YPO1307	--	membrane protein	2.2
YPTB1345	YPO1314	--	glutathione S-transferase-family protein	3.5
YPTB1392	YPO1366	<i>cspD</i>	cold shock-like protein	2.8
YPTB1448	YPO1423a	<i>rmf</i>	ribosome modulation factor	2.8
YPTB1577	YPO1567	--	racemase	2.1
YPTB1578	YPO1569	<i>lldD</i>	L-lactate dehydrogenase	2.2
YPTB1654	YPO1778	--	ASCH domain-containing protein	2.3
YPTB1655	YPO1779	--	hypothetical protein	2.6
YPTB1708	YPO1834	--	DNA-3-methyladenine glycosidase	2.5
YPTB1955	YPO1957	<i>phoH</i>	hypothetical protein	2.6
YPTB1965	YPO1971	<i>hutG</i>	N-formylglutamate amidohydrolase	2.2
YPTB1979	YPO1986	--	hypothetical protein	2.9
YPTB1987	YPO1995	--	hypothetical protein	2.6
YPTB1988	YPO1996	--	hypothetical protein	2.4
YPTB2062	YPO2080	--	hypothetical protein	3.7
YPTB2063	YPO2081	--	lipoprotein	2.1
YPTB2079	YPO2152	--	hypothetical protein	2.3
YPTB2124	YPO2202	--	lipoprotein	3.4
YPTB2149	YPO2227	<i>pyrF</i>	orotidine 5'-phosphate decarboxylase	2.6
YPTB2151	YPO2229	<i>osmB</i>	lipoprotein	3.8
YPTB2192	YPO2270	--	voltage-gated ClC-type chloride channel ClcB	4.2
YPTB2223	YPO2301	--	universal stress protein UspE	2.2
YPTB2253	YPO2334	<i>nifJ</i>	pyruvate-flavodoxin oxidoreductase	10.2
YPTB2263	YPO2345	--	stress protection protein MarC	2.1
YPTB2270	YPO2351	<i>pspA</i>	phage shock protein	2.6
YPTB2280	YPO2363	--	hypothetical protein	2.6
YPTB2281	YPO2367	<i>gst</i>	glutathione S-transferase	2.0
YPTB2285	YPO2371	--	lipoprotein	2.5
YPTB2299	YPO2386	<i>sodB</i>	superoxide dismutase	3.3
YPTB2303	YPO2390	<i>cfa</i>	cyclopropane fatty acyl phospholipid synthase	2.4
YPTB2306	YPO2393	<i>pykF</i>	pyruvate kinase	3.6
YPTB2317	YPO2408	--	inner membrane protein	2.4
YPTB2375	YPO1706	<i>htpX</i>	heat shock protein	2.6
YPTB2423	YPO1645	--	NAD(P)-dependent oxidoreductase	2.4
YPTB2444	YPO1624	<i>ycfJ</i>	hypothetical protein	6.5
YPTB2445	YPO1620	--	hypothetical protein	2.5
YPTB2532	YPO2496	--	tartrate dehydrogenase	2.8

YPTB2542	YPO2506	<i>ompX</i>	outer membrane protein X	4.4
YPTB2546	YPO2510	<i>dps</i>	DNA starvation/stationary phase protection protein	3.2
YPTB2563	YPO2531	<i>elaB</i>	hypothetical protein	2.7
YPTB2603	YPO2781	--	NUDIX hydrolase	2.3
YPTB2655	YPO2728	--	Type VI secretion system locus 3 lysozyme	2.2
YPTB2704	YPO2981	--	hypothetical protein	7.3
YPTB2745	YPO3027	<i>ygiW</i>	hypothetical protein	2.8
YPTB2813	YPO2847	<i>yegM</i>	multidrug efflux system subunit MdtA	3.6
YPTB2819	YPO2854	--	hypothetical protein	2.0
YPTB2821	YPO2856	--	lipid kinase	2.5
YPTB2901	YPO2707	<i>yplB</i>	phospholipase A accessory protein	2.2
YPTB2916	YPO2692	<i>kdpA</i>	potassium-transporting ATPase subunit A	3.4
YPTB2934	YPO2675	<i>kch</i>	voltage-gated potassium channel	2.2
YPTB2935	YPO2674	<i>hdeB</i>	acid-resistance protein	49.3
YPTB2937	YPO2672	--	urea transporter	2.5
YPTB2939	YPO2670	<i>ureG</i>	urease accessory protein	5.9
YPTB2940	YPO2669	<i>ureF</i>	urease accessory protein	3.3
YPTB2941	YPO2668	<i>ureE</i>	urease accessory protein	7.9
YPTB2942	YPO2667	<i>ureC</i>	urease subunit alpha	7.8
YPTB2943	YPO2666	<i>ureB</i>	urease subunit beta	3.5
YPTB2944	YPO2665	<i>ureA</i>	urease subunit gamma	6.5
YPTB2952	YPO2654	<i>yicN</i>	hypothetical protein	4.8
YPTB2980	YPO1066	--	peptidyl-tRNA hydrolase domain protein	2.4
YPTB2999	YPO1048	<i>dxr</i>	1-deoxy-D-xylulose 5-phosphate reductoisomerase	2.0
YPTB3125	YPO0883	--	transcriptional regulator	4.2
YPTB3126	YPO0884	--	bacteriophage protein	3.4
YPTB3211	YPO0939	--	agmatine deiminase	2.4
YPTB3468	YPO0590	<i>hdeD</i>	acid-resistance membrane protein	2.0
YPTB3700	YPO0206	<i>bfr</i>	bacterioferritin	2.6
YPTB3724	YPO0180	--	hydrolase	2.8
YPTB3770	YPO0130	--	hypothetical protein	4.5
YPTB3821	YPO3980	<i>glxK</i>	glycerate kinase	2.4
YPTB3827	YPO3987	--	hypothetical protein	2.1
YPTB3850	YPO4015	<i>hutT</i>	APC family histidine permease	2.7
YPTB3851	YPO4016	<i>hutH</i>	histidine ammonia-lyase	6.4
YPTB3852	YPO4017	<i>hutU</i>	urocanate hydratase	9.1
YPTB3928	YPO4057	<i>fdoH</i>	formate dehydrogenase-O, iron-sulfur subunit	7.6
YPTB3929	YPO4056	<i>fdol</i>	formate dehydrogenase-O subunit gamma	7.7
YPTB3930	YPO4055	<i>fdhE</i>	formate dehydrogenase accessory protein	2.4
YPTB3931	YPO4054	<i>selA</i>	selenocysteine synthase	2.0
<b>14 days after infection:</b>				
YPTB0003	YPO0003	<i>asnA</i>	asparagine synthetase AsnA	2.3
YPTB0092	YPO0100	--	hypothetical protein	5.0

YPTB0093	YPO0101	--	hypothetical protein	5.6
YPTB0094	YPO0102	--	hypothetical protein	5.4
YPTB0139	YPO3893	--	membrane protein	2.6
YPTB0141	YPO3894	--	membrane protein	2.2
YPTB0158	YPO3879	--	outer membrane fimbrial usher porin	3.2
YPTB0160	YPO3877	--	fimbrial protein	14.5
YPTB0189	YPO3846	--	hypothetical protein	2.3
YPTB0207	YPO3828	--	viral enhancin family protein	2.1
YPTB0323	YPO0267	--	type III secretion system ATPase	2.0
YPTB0358	YPO0301	--	hypothetical protein	3.4
YPTB0365	YPO0309	--	autotransporter protein	2.0
YPTB0437	YPO3540	--	hypothetical protein	2.2
YPTB0542	YPO0402	<i>frwD</i>	fructose-like phosphotransferase EIIB subunit 3	2.7
YPTB0543	YPO0403	<i>frwB</i>	PTS system fructose-like transporter subunit EIIB	2.9
YPTB0544	YPO0404	<i>frwC</i>	fructose-like permease EIIC subunit 2	3.9
YPTB0569	YPO0424	--	pectinesterase A precursor (pectin methylesterase A)	2.6
YPTB0576	YPO0431	<i>osmY</i>	molecular chaperone periplasmic protein	14.7
YPTB0577	YPO0432	--	DUF1328 domain-containing protein	7.6
YPTB0639	YPO0498	--	Type VI secretion system locus 4 (T6SS-4) protein	6.7
YPTB0640	YPO0499	--	T6SS-4 ImpA domain protein TssC	5.2
YPTB0641	YPO0500	--	T6SS-4 protein TssB	7.4
YPTB0642	YPO0501	--	T6SS-4 EvpB family protein ImpC	6.7
YPTB0643	YPO0502	<i>hcp</i>	T6SS-4 protein Hcp	3.9
YPTB0644	YPO0503	--	T6SS-4 lysozyme-like protein ImpF	4.6
YPTB0645	YPO0504	--	T6SS-4 protein TssF	4.4
YPTB0646	YPO0505	--	T6SS-4 protein TssG	4.3
YPTB0647	YPO0506	<i>clpB</i>	T6SS-4 ATP-dependent protease ClpB	3.8
YPTB0648	YPO0507	--	T6SS-4 protein VgrG	4.9
YPTB0649	YPO0509	--	T6SS-4 pentapeptide-4 family protein	4.5
YPTB0650	YPO0510	--	T6SS-4 pentapeptide-4 family protein	14.9
YPTB0651	YPO0511	--	T6SS-4 protein, TagC family	39.3
YPTB0652	YPO0511a	--	T6SS-4 PAAR-family protein	15.9
YPTB0653	YPO0512	--	T6SS-4 protein TssJ	11.0
YPTB0654	YPO0513	--	T6SS-4 protein ImpL	6.6
YPTB0655	YPO0514	--	T6SS-4 protein ImpK	6.6
YPTB0656	YPO0515	--	T6SS-4 membrane protein IcmF	5.3
YPTB0657	YPO0516	--	T6SS-4 hypothetical protein	13.0
YPTB0800	YPO3331	--	ABC sugar transporter, permease subunit	2.0
YPTB0803	YPO3327	--	DeoR family transcriptional regulator	2.1
YPTB0841	YPO3286	<i>aroF</i>	phospho-2-dehydro-3-deoxyheptonate aldolase	2.2
YPTB0863	YPO3260	--	hypothetical protein	2.0
YPTB0910	YPO3216	--	methyltransferase	3.6
YPTB0978	YPO3138	<i>ymoA</i>	hemolysin expression-modulating protein	2.0

YPTB0980	YPO3136	--	hypothetical protein	2.3
YPTB0998	YPO3116	<i>ddhD</i>	CDP-6-deoxy-delta-3,4-glucoseen reductase	2.7
YPTB1002	YPO3112	<i>prt</i>	paratose synthase	3.5
YPTB1003	YPO3111	<i>wbyH</i>	hypothetical protein	4.0
YPTB1004	YPO3110	<i>wzx</i>	O-unit flippase	5.3
YPTB1006	YPO3107	<i>wbyJ</i>	mannosyltransferase	4.3
YPTB1008	YPO3104	<i>wbyK</i>	mannosyltransferase	5.7
YPTB1010	y1080	<i>fcl</i>	GDP-fucose synthetase	5.4
YPTB1011	YPO3099	<i>manC</i>	mannose-1-phosphate guanylyltransferase	5.4
YPTB1012	YPO3098	<i>wbyL</i>	glycosyltransferase	7.7
YPTB1013	YPO3097	<i>manB</i>	phosphomannomutase	10.4
YPTB1014	YPO3096	<i>wzz</i>	ferric enterobactin transport protein FepE	6.1
YPTB1039	YPO2822	--	hypothetical protein	2.7
YPTB1071	YPO2577	--	methylmalonate-semialdehyde dehydrogenase	2.8
YPTB1074	YPO2581	--	ABC type sugar-binding periplasmic protein	6.3
YPTB1076	YPO2583	--	ABC type sugar transport system permease protein	4.4
YPTB1077	YPO2584	--	myo-inositol 2-dehydrogenase	5.4
YPTB1086	YPO2593	--	LuxR family regulatory protein	11.7
YPTB1151	YPO1117	<i>cydA</i>	cytochrome D ubiquinol oxidase subunit I	2.0
YPTB1152	YPO1118	<i>cydB</i>	cytochrome D ubiquinol oxidase subunit II	2.3
YPTB1167	YPO1134	<i>psiF</i>	starvation-inducible protein	2.0
YPTB1186	YPO1155	--	ABC transporter, ATP binding subunit	2.5
YPTB1197	YPO1167	<i>betI</i>	transcriptional regulator	8.5
YPTB1221	YPO1180	--	hypothetical protein	2.9
YPTB1222	YPO1181	--	membrane protein	2.2
YPTB1231	YPO1190	--	ABC branch chain aa transporter, ATP-binding subunit	2.4
YPTB1241	YPO1201	<i>adiA</i>	arginine decarboxylase	2.3
YPTB1261	YPO1222	--	outer membrane porin protein C	4.4
YPTB1291	YPO1255	--	hypothetical protein	2.1
YPTB1305	YPO1271	<i>yejE</i>	microcin C ABC transporter permease, CAMP resistance	2.1
YPTB1309	YPO1275	<i>spr</i>	outer membrane lipoprotein	2.1
YPTB1333	YPO1302	<i>psaF</i>	inner membrane protein	3.5
YPTB1334	YPO1303	<i>psaA</i>	pH 6 antigen precursor (adhesin)	80.6
YPTB1335	YPO1304	<i>psaB</i>	chaperone protein PsaB precursor	5.0
YPTB1345	YPO1314	--	glutathione S-transferase-family protein	2.2
YPTB1392	YPO1366	<i>cspD</i>	cold shock-like protein	3.6
YPTB1422	YPO1397	--	DUF1338 domain-containing protein	2.4
YPTB1486	YPO0975	--	Type VI secretion system locus 2 (T6SS-2) protein	2.2
YPTB1505	YPO1488	--	T6SS-2 protein	2.6
YPTB1630	YPO1754	<i>yebN</i>	hypothetical protein	2.0
YPTB1664	YPO1789	--	hypothetical protein	2.2
YPTB1684	YPO1811	--	short chain dehydrogenase	2.4
YPTB1921	YPO1922	--	fimbrial protein	4.7

YPTB1979	YPO1986	--	hypothetical protein	3.2
YPTB1985	YPO1993	--	dehydrogenase	4.8
YPTB1986	YPO1994	--	hypothetical protein	3.7
YPTB1987	YPO1995	--	hypothetical protein	3.7
YPTB1988	YPO1996	--	hypothetical protein	2.7
YPTB2062	YPO2080	--	hypothetical protein	2.9
YPTB2151	YPO2229	<i>osmB</i>	lipoprotein	3.5
YPTB2158	YPO2237	--	major facilitator superfamily tartrate transporter	2.4
YPTB2159	YPO2238	--	hypothetical protein	2.5
YPTB2203	YPO2284	--	hypothetical protein	2.0
YPTB2236	YPO2317	--	hypothetical protein	2.7
YPTB2239	YPO2320	--	DNA-binding phage-related protein	2.3
YPTB2251	YPO2332	<i>mgtC2</i>	Mg(2+) transport ATPase	2.1
YPTB2269	YPO2350	<i>pspB</i>	phage shock protein B	2.3
YPTB2279	YPO2362	--	YIP1 family protein	5.7
YPTB2285	YPO2371	--	lipoprotein	2.7
YPTB2293	YPO2379	<i>nema</i>	N-ethylmaleimide reductase	2.1
YPTB2294	YPO2380	<i>sepC</i>	insecticidal toxin	2.6
YPTB2301	YPO2388	--	LysR family transcriptional regulator	2.2
YPTB2306	YPO2393	<i>pykF</i>	pyruvate kinase	2.4
YPTB2314	YPO2404	<i>sufA</i>	iron-sulfur cluster assembly scaffold protein	2.3
YPTB2317	YPO2408	--	inner membrane protein	2.6
YPTB2336	YPO2428	<i>pheT</i>	phenylalanyl-tRNA synthetase subunit beta	2.2
YPTB2393	YPO1686	--	hypothetical protein	2.4
YPTB2423	YPO1645	--	NAD(P)-dependent oxidoreductase	2.0
YPTB2444	YPO1624	<i>ycfJ</i>	hypothetical membrane protein, glycine zipper domain	20.1
YPTB2542	YPO2506	<i>ompX</i>	outer membrane protein X	2.9
YPTB2548	YPO2512	<i>glnH</i>	glutamine ABC transporter periplasmic protein	2.3
YPTB2573	YPO2541	--	hypothetical protein	2.2
YPTB2588	YPO2556	<i>rovM</i>	LysR family transcriptional regulator	2.1
YPTB2603	YPO2781	--	NUDIX hydrolase	2.0
YPTB2624	YPO2759	<i>smfA</i>	fimbrial protein	4.3
YPTB2664	YPO2937	--	Type VI secretion system locus 3 (T6SS-3) Hcp1 protein	2.7
YPTB2672	YPO2947	--	T6SS-3 protein	2.2
YPTB2687	YPO2963	--	hypothetical protein	2.3
YPTB2704	YPO2981	--	hypothetical protein	9.2
YPTB2746	YPO3028	--	pertactin family virulence factor/autotransporter	3.1
YPTB2770	YPO3048	--	ABC transporter ATP-binding protein	2.2
YPTB2772	YPO3050	--	ABC transporter, periplasmic iron binding protein	2.2
YPTB2813	YPO2847	<i>yegM</i>	multidrug efflux system subunit MdtA	2.2
YPTB2821	YPO2856	--	lipid kinase	2.4
YPTB2906	YPO2702	--	membrane protein	2.0
YPTB2907	YPO2701	--	membrane protein	2.2

YPTB2915	YPO2693	<i>ybfA</i>	membrane protein	3.2
YPTB2935	YPO2674	<i>hdeB</i>	acid-resistance protein	13.3
YPTB2936	YPO2673	--	nickel transport (NiCoT family) protein	2.3
YPTB2939	YPO2670	<i>ureG</i>	urease accessory protein	2.5
YPTB2940	YPO2669	<i>ureF</i>	urease accessory protein	2.8
YPTB2941	YPO2668	<i>ureE</i>	urease accessory protein	2.7
YPTB2942	YPO2667	<i>ureC</i>	urease subunit alpha	2.1
YPTB2952	YPO2654	<i>yicN</i>	membrane protein	6.4
YPTB2980	YPO1066	--	peptidyl-tRNA hydrolase domain protein	2.1
YPTB2999	YPO1048	<i>dxr</i>	1-deoxy-D-xylulose 5-phosphate reductoisomerase	2.3
YPTB3125	YPO0883	--	transcriptional regulator	7.9
YPTB3126	YPO0884	--	bacteriophage protein	2.2
YPTB3328	YPO0735	--	hypothetical protein	2.1
YPTB3410	YPO0651	--	signal transduction protein	2.0
YPTB3446	YPO0609	--	ABC sugar transporter, ATP-binding subunit	2.6
YPTB3512	YPO3568	<i>degS</i>	serine endoprotease	2.3
YPTB3613	YPO3606	--	Type IV secretion protein Rhs	3.6
YPTB3637	YPO3706	--	Type VI secretion system locus 1 (T6SS-1) protein	2.3
YPTB3700	YPO0206	<i>bfr</i>	bacterioferritin	2.3
YPTB3770	YPO0130	--	hypothetical protein	2.0
YPTB3814	YPO3973	--	metalloprotease	3.7
YPTB3828	YPO3988	--	cyclic-di-GMP phosphodiesterase (untranslated in Yp)	2.2
YPTB3842	YPO4003	<i>dppA</i>	ABC transporter, periplasmic dipeptide binding protein	2.4
YPTB3851	YPO4016	<i>hutH</i>	histidine ammonia-lyase	2.9
YPTB3852	YPO4017	<i>hutU</i>	urocanate hydratase	3.8
YPTB3896	YPO4044	--	fimbrial protein	8.5
YPTB3928	YPO4057	<i>fdoH</i>	formate dehydrogenase-O, iron-sulfur subunit	7.7
YPTB3929	YPO4056	<i>fdol</i>	formate dehydrogenase-O subunit gamma	8.7
YPTB3930	YPO4055	<i>fdhE</i>	formate dehydrogenase accessory protein	2.2
YPTB3931	YPO4054	<i>selA</i>	selenocysteine synthase	2.6

<sup>a</sup> Annotation numbers of the *Y. pseudotuberculosis* IP32953 (YPTB) and *Y. pestis* CO92 (YPO) homologs  
Criteria:  $\geq 2$ -fold difference;  $p$ -value  $\leq 0.01$ ;  $\geq 98\%$  nucleotide sequence identity between the homologs