

**Supplementary Table 2.** All significantly mutated genes. Multiple mutations in one gene in one individual are counted as one. CT, convolution test.

**Cocker spaniel, B-cell**

Gene	geneID	P-value CT	FDR CT
<i>ENSCAFG00000030674</i>	<i>FAM90A1</i>	3.47E-09	8.51E-05
<i>ENSCAFG00000014251</i>	<i>DDX3X</i>	1.72E-08	2.10E-04
<i>ENSCAFG00000018075</i>	<i>TRAF3</i>	6.44E-08	5.26E-04
<i>ENSCAFG00000006496</i>	<i>MITF</i>	1.70E-07	1.04E-03
<i>ENSCAFG00000001396</i>	<i>PSMA1</i>	4.11E-07	2.02E-03
<i>ENSCAFG00000001086</i>	<i>MYC</i>	1.46E-06	5.98E-03
<i>ENSCAFG00000001754</i>	<i>GRIFIN</i>	6.07E-06	2.13E-02
<i>ENSCAFG00000016403</i>	<i>POT1</i>	8.15E-06	2.22E-02

**Golden retriever, B-cell**

Gene	geneID	P-value CT	FDR CT
<i>ENSCAFG00000008141</i>	<i>FBXW7</i>	0.00E+00	0.00E+00
<i>ENSCAFG00000001754</i>	<i>POT1</i>	1.10E-22	1.34E-18
<i>ENSCAFG00000018075</i>	<i>TRAF3</i>	1.56E-19	1.28E-15
<i>ENSCAFG00000030674</i>	<i>FAM90A1</i>	2.36E-18	1.45E-14
<i>ENSCAFG00000031638</i>	<i>ENSCAFG000</i>	5.30E-18	2.60E-14
<i>ENSCAFG00000016714</i>	<i>TP53</i>	2.25E-17	9.18E-14
<i>ENSCAFG00000030839</i>	<i>PNRC1</i>	1.07E-12	3.76E-09
<i>ENSCAFG00000000578</i>	<i>FKBP3</i>	1.26E-09	3.32E-06
<i>ENSCAFG00000025100</i>	<i>TBC1D26</i>	1.13E-09	3.32E-06
<i>ENSCAFG00000017753</i>	<i>RPL23A</i>	1.35E-09	3.32E-06
<i>ENSCAFG00000025123</i>	<i>FAM90A1</i>	6.43E-09	1.43E-05
<i>ENSCAFG00000006180</i>	<i>SOCS2</i>	7.75E-09	1.58E-05
<i>ENSCAFG00000001396</i>	<i>PSMA1</i>	1.21E-08	2.28E-05
<i>ENSCAFG00000014251</i>	<i>DDX3X</i>	1.99E-08	3.48E-05
<i>ENSCAFG00000013392</i>	<i>SETD2</i>	3.33E-08	5.44E-05
<i>ENSCAFG00000013774</i>	<i>MAP3K14</i>	1.50E-07	2.17E-04
<i>ENSCAFG00000005151</i>	<i>BRK1</i>	3.73E-07	5.08E-04
<i>ENSCAFG00000029820</i>	<i>ENSCAFG000</i>	4.89E-07	6.31E-04
<i>ENSCAFG00000017032</i>	<i>ENSCAFG000</i>	7.47E-07	9.16E-04
<i>ENSCAFG00000030482</i>	<i>ENSCAFG000</i>	8.30E-07	9.69E-04
<i>ENSCAFG00000030950</i>	<i>ENSCAFG000</i>	1.46E-06	1.63E-03
<i>ENSCAFG00000013453</i>	<i>KLRK1</i>	1.88E-06	2.00E-03
<i>ENSCAFG00000010684</i>	<i>LINS</i>	1.99E-06	2.04E-03
<i>ENSCAFG00000014042</i>	<i>KLRK1</i>	2.27E-06	2.22E-03
<i>ENSCAFG00000003796</i>	<i>MAPRE1</i>	2.39E-06	2.25E-03
<i>ENSCAFG00000014958</i>	<i>RPL22</i>	3.15E-06	2.86E-03

<i>ENSCAFG00000009912</i>	<i>ERG</i>	3.79E-06	3.31E-03
<i>ENSCAFG00000028928</i>	<i>OR5AC1</i>	4.74E-06	4.01E-03
<i>ENSCAFG00000017316</i>	<i>ENSCAFG000</i>	5.63E-06	4.61E-03
<i>ENSCAFG00000013551</i>	<i>ATP5H</i>	6.02E-06	4.76E-03
<i>ENSCAFG00000029241</i>	<i>ENSCAFG000</i>	6.53E-06	4.85E-03
<i>ENSCAFG00000029904</i>	<i>HBA1</i>	6.39E-06	4.85E-03
<i>ENSCAFG00000016289</i>	<i>CTB-167G5.5</i>	7.40E-06	5.33E-03
<i>ENSCAFG00000011598</i>	<i>KPNA2</i>	1.03E-05	7.20E-03
<i>ENSCAFG00000019962</i>	<i>TAF1C</i>	1.15E-05	7.80E-03
<i>ENSCAFG00000013060</i>	<i>PKD1</i>	1.21E-05	7.82E-03
<i>ENSCAFG00000016528</i>	<i>NTRK1</i>	1.21E-05	7.82E-03
<i>ENSCAFG00000032009</i>	<i>ENSCAFG000</i>	1.35E-05	8.51E-03
<i>ENSCAFG00000000595</i>	<i>ENSCAFG000</i>	1.46E-05	8.92E-03
<i>ENSCAFG00000016251</i>	<i>EMR2</i>	1.57E-05	9.39E-03
<i>ENSCAFG00000030976</i>	<i>ENSCAFG000</i>	1.83E-05	1.07E-02
<i>ENSCAFG00000010012</i>	<i>ST13</i>	1.90E-05	1.09E-02
<i>ENSCAFG00000024522</i>	<i>ENSCAFG000</i>	1.99E-05	1.11E-02
<i>ENSCAFG00000032455</i>	<i>ENSCAFG000</i>	2.07E-05	1.13E-02
<i>ENSCAFG00000009973</i>	<i>EEF1A2</i>	2.16E-05	1.15E-02
<i>ENSCAFG00000006036</i>	<i>HNRNPA1P1</i>	2.33E-05	1.21E-02
<i>ENSCAFG00000025327</i>	<i>SOX17</i>	2.40E-05	1.22E-02
<i>ENSCAFG00000001336</i>	<i>ISCA1</i>	2.51E-05	1.26E-02
<i>ENSCAFG00000030845</i>	<i>HIST2H3PS2</i>	2.62E-05	1.29E-02
<i>ENSCAFG00000014107</i>	<i>RPL23A</i>	3.23E-05	1.52E-02
<i>ENSCAFG00000018032</i>	<i>C16orf88</i>	3.91E-05	1.81E-02
<i>ENSCAFG00000029913</i>	<i>ENSCAFG000</i>	6.40E-05	2.85E-02
<i>ENSCAFG00000019424</i>	<i>PKD1</i>	6.68E-05	2.92E-02
<i>ENSCAFG00000006873</i>	<i>ZDHHC2</i>	7.21E-05	3.05E-02
<i>ENSCAFG00000004640</i>	<i>EEF1A1</i>	7.21E-05	3.05E-02
<i>ENSCAFG00000006663</i>	<i>intron of SNX</i>	7.78E-05	3.23E-02
<i>ENSCAFG00000031340</i>	<i>ENSCAFG000</i>	9.09E-05	3.60E-02
<i>ENSCAFG00000005959</i>	<i>CWC15</i>	8.99E-05	3.60E-02
<i>ENSCAFG00000020326</i>	<i>DUS2L</i>	8.90E-05	3.60E-02
<i>ENSCAFG00000000039</i>	<i>DOK6</i>	9.63E-05	3.75E-02
<i>ENSCAFG00000005185</i>	<i>XRN2</i>	9.91E-05	3.80E-02
<i>ENSCAFG00000024545</i>	<i>PDIA6</i>	1.09E-04	3.90E-02
<i>ENSCAFG00000014786</i>	<i>PHC3</i>	1.09E-04	3.90E-02
<i>ENSCAFG00000031200</i>	<i>ENSCAFG000</i>	1.06E-04	3.90E-02
<i>ENSCAFG00000008450</i>	<i>WDR17</i>	1.10E-04	3.90E-02
<i>ENSCAFG00000028889</i>	<i>USP17L2</i>	1.05E-04	3.90E-02
<i>ENSCAFG00000003493</i>	<i>ENSCAFG000</i>	1.21E-04	4.22E-02
<i>ENSCAFG00000004229</i>	<i>GLUD2</i>	1.26E-04	4.28E-02

<i>ENSCAFG00000008814</i>	<i>ENSCAFG000</i>	1.25E-04	4.28E-02
<i>ENSCAFG00000006166</i>	<i>MDH2</i>	1.51E-04	4.99E-02
<i>ENSCAFG000000031827</i>	<i>ZNF486</i>	1.50E-04	4.99E-02

### Boxer, T-cell

Gene	geneID	P-value CT	FDR CT
<i>ENSCAFG000000015670</i>	<i>PTEN</i>	2.52E-11	6.19E-07
<i>ENSCAFG000000005839</i>	<i>SATB1</i>	3.61E-10	4.42E-06
<i>ENSCAFG000000017298</i>	<i>MAP2K1</i>	2.28E-06	1.86E-02
<i>ENSCAFG000000006937</i>	<i>EEF1A1</i>	6.40E-06	3.26E-02
<i>ENSCAFG000000006714</i>	<i>NLRP14</i>	6.64E-06	3.26E-02
<i>ENSCAFG000000024216</i>	<i>KCND2</i>	1.22E-05	4.99E-02

### Golden retriever, T-cell

Gene	geneID	P-value CT	FDR CT
<i>ENSCAFG000000001396</i>	<i>PSMA1</i>	4.86E-13	1.19E-08
<i>ENSCAFG000000024399</i>	<i>COX8A</i>	1.51E-11	1.85E-07
<i>ENSCAFG000000006440</i>	<i>LTA4H</i>	1.95E-09	1.19E-05
<i>ENSCAFG000000025100</i>	<i>TBC1D26</i>	1.57E-09	1.19E-05
<i>ENSCAFG000000000584</i>	<i>ZNF706</i>	1.77E-08	8.69E-05
<i>ENSCAFG000000013551</i>	<i>ATP5H</i>	7.49E-08	3.06E-04
<i>ENSCAFG000000031638</i>	<i>ENSCAFG000</i>	1.45E-07	5.09E-04
<i>ENSCAFG000000014463</i>	<i>PTPN6</i>	3.23E-07	9.91E-04
<i>ENSCAFG000000002501</i>	<i>NLRP5</i>	3.68E-07	1.00E-03
<i>ENSCAFG000000004229</i>	<i>GLUD2</i>	6.04E-07	1.48E-03
<i>ENSCAFG000000013232</i>	<i>RPL11</i>	6.92E-07	1.54E-03
<i>ENSCAFG000000005839</i>	<i>SATB1</i>	3.44E-06	7.04E-03
<i>ENSCAFG000000017753</i>	<i>RPL23A</i>	4.08E-06	7.70E-03
<i>ENSCAFG000000011017</i>	<i>KRTAP10-6</i>	5.13E-06	8.98E-03
<i>ENSCAFG000000019029</i>	<i>MAGEC2</i>	6.38E-06	1.04E-02
<i>ENSCAFG000000002232</i>	<i>HNRNPA1L2</i>	1.05E-05	1.61E-02
<i>ENSCAFG000000029913</i>	<i>ENSCAFG000</i>	1.73E-05	2.23E-02
<i>ENSCAFG000000011895</i>	<i>PTAFR</i>	1.59E-05	2.23E-02
<i>ENSCAFG000000008141</i>	<i>FBXW7</i>	2.19E-05	2.68E-02
<i>ENSCAFG000000015252</i>	<i>NME7</i>	2.97E-05	3.47E-02

### All B-cell (cocker spaniel + golden retriever)

Gene	geneID	P-value CT	FDR CT
<i>ENSCAFG000000001754</i>	<i>POT1</i>	0.00E+00	0.00E+00
<i>ENSCAFG000000008141</i>	<i>FBXW7</i>	0.00E+00	0.00E+00
<i>ENSCAFG000000018075</i>	<i>TRAF3</i>	0.00E+00	0.00E+00
<i>ENSCAFG000000030674</i>	<i>FAM90A1</i>	0.00E+00	0.00E+00

ENSCAFG00000016714	TP53	1.25E-22	6.11E-19
ENSCAFG00000031638	ENSCAFG000	2.62E-20	1.07E-16
ENSCAFG00000014251	DDX3X	7.44E-15	2.60E-11
ENSCAFG00000001396	PSMA1	4.69E-14	1.44E-10
ENSCAFG00000017753	RPL23A	2.72E-12	7.03E-09
ENSCAFG00000030839	PNRC1	2.87E-12	7.03E-09
ENSCAFG00000013392	SETD2	2.42E-11	5.40E-08
ENSCAFG00000013774	MAP3K14	1.10E-10	2.24E-07
ENSCAFG00000000578	FKBP3	3.37E-09	5.90E-06
ENSCAFG00000025100	TBC1D26	3.17E-09	5.90E-06
ENSCAFG00000006180	SOCS2	1.17E-08	1.91E-05
ENSCAFG00000010684	LINS	1.39E-08	2.02E-05
ENSCAFG00000028928	OR5AC1	1.40E-08	2.02E-05
ENSCAFG00000025123	FAM90A1	1.66E-08	2.26E-05
ENSCAFG00000009912	ERG	3.25E-08	4.19E-05
ENSCAFG00000006036	HNRNPA1P1(	1.45E-07	1.77E-04
ENSCAFG00000009973	EEF1A2	1.70E-07	1.98E-04
ENSCAFG00000030482	ENSCAFG000	7.76E-07	7.81E-04
ENSCAFG00000028889	USP17L2	7.34E-07	7.81E-04
ENSCAFG00000029820	ENSCAFG000	7.96E-07	7.81E-04
ENSCAFG00000005151	BRK1	1.02E-06	9.63E-04
ENSCAFG00000017032	ENSCAFG000	1.33E-06	1.21E-03
ENSCAFG00000030950	ENSCAFG000	2.11E-06	1.85E-03
ENSCAFG00000013453	KLRK1	2.27E-06	1.92E-03
ENSCAFG00000003297	LRRN3	2.37E-06	1.94E-03
ENSCAFG00000014042	KLRK1	3.71E-06	2.93E-03
ENSCAFG00000019424	PKD1	5.56E-06	4.13E-03
ENSCAFG00000003796	MAPRE1	5.41E-06	4.13E-03
ENSCAFG00000000608	ARID1B	6.57E-06	4.74E-03
ENSCAFG00000015326	SLC38A5	7.84E-06	5.27E-03
ENSCAFG00000029241	ENSCAFG000	8.38E-06	5.27E-03
ENSCAFG00000014958	RPL22	8.33E-06	5.27E-03
ENSCAFG00000013551	ATP5H	7.79E-06	5.27E-03
ENSCAFG00000000749	ENSCAFG000	8.30E-06	5.27E-03
ENSCAFG00000029054	ENSCAFG000	1.15E-05	6.88E-03
ENSCAFG00000017316	ENSCAFG000	1.15E-05	6.88E-03
ENSCAFG00000016289	CTB-167G5.5	1.27E-05	7.30E-03
ENSCAFG00000029904	HBA1	1.28E-05	7.30E-03
ENSCAFG00000019962	TAF1C	1.70E-05	9.19E-03
ENSCAFG00000011598	KPNA2	1.65E-05	9.19E-03
ENSCAFG00000016528	NTRK1	1.72E-05	9.19E-03
ENSCAFG00000000595	ENSCAFG000	1.99E-05	1.04E-02

<i>ENSCAFG00000032009</i>	<i>ENSCAFG000</i>	2.20E-05	1.12E-02
<i>ENSCAFG00000010012</i>	<i>ST13</i>	2.29E-05	1.13E-02
<i>ENSCAFG00000025327</i>	<i>SOX17</i>	2.31E-05	1.13E-02
<i>ENSCAFG00000006496</i>	<i>MITF</i>	2.39E-05	1.15E-02
<i>ENSCAFG00000032455</i>	<i>ENSCAFG000</i>	2.51E-05	1.19E-02
<i>ENSCAFG00000024522</i>	<i>ENSCAFG000</i>	2.64E-05	1.22E-02
<i>ENSCAFG00000016251</i>	<i>EMR2</i>	2.89E-05	1.31E-02
<i>ENSCAFG00000001336</i>	<i>ISCA1</i>	3.09E-05	1.38E-02
<i>ENSCAFG00000017103</i>	<i>TAF1L</i>	3.81E-05	1.67E-02
<i>ENSCAFG00000030845</i>	<i>HIST2H3PS2</i>	3.95E-05	1.70E-02
<i>ENSCAFG00000029913</i>	<i>ENSCAFG000</i>	4.32E-05	1.83E-02
<i>ENSCAFG00000014107</i>	<i>ENSCAFG000</i>	4.67E-05	1.94E-02
<i>ENSCAFG00000013060</i>	<i>PDK1</i>	6.39E-05	2.53E-02
<i>ENSCAFG00000018032</i>	<i>C16orf88</i>	7.02E-05	2.73E-02
<i>ENSCAFG00000017134</i>	<i>OGT</i>	9.24E-05	3.49E-02
<i>ENSCAFG00000031340</i>	<i>ENSCAFG000</i>	9.15E-05	3.49E-02
<i>ENSCAFG00000001086</i>	<i>MYC</i>	9.87E-05	3.67E-02
<i>ENSCAFG00000031200</i>	<i>ENSCAFG000</i>	1.07E-04	3.91E-02
<i>ENSCAFG00000014786</i>	<i>PHC3</i>	1.22E-04	4.38E-02
<i>ENSCAFG00000005959</i>	<i>CWC15</i>	1.28E-04	4.53E-02
<i>ENSCAFG00000006873</i>	<i>ZDHHC2</i>	1.32E-04	4.55E-02
<i>ENSCAFG00000013599</i>	<i>HRG</i>	1.31E-04	4.55E-02
<i>ENSCAFG00000004640</i>	<i>ENSCAFG000</i>	1.38E-04	4.62E-02
<i>ENSCAFG00000016403</i>	<i>GRIFIN</i>	1.37E-04	4.62E-02
<i>ENSCAFG00000003493</i>	<i>ENSCAFG000</i>	1.42E-04	4.69E-02
<i>ENSCAFG00000024545</i>	<i>ENSCAFG000</i>	1.55E-04	4.88E-02
<i>ENSCAFG00000000039</i>	<i>DOK6</i>	1.56E-04	4.88E-02
<i>ENSCAFG00000005185</i>	<i>XRN2</i>	1.59E-04	4.88E-02
<i>ENSCAFG00000031054</i>	<i>ENSCAFG000</i>	1.58E-04	4.88E-02
<i>ENSCAFG00000006663</i>	<i>ENSCAFG000</i>	1.59E-04	4.88E-02
<i>ENSCAFG00000020326</i>	<i>DUS2L</i>	1.58E-04	4.88E-02

**All T-cell (boxer + golden retriever)**

Gene	geneID	P-value CT	FDR CT
<i>ENSCAFG00000005839</i>	<i>SATB1</i>	2.40E-15	5.88E-11
<i>ENSCAFG00000025100</i>	<i>TBC1D26</i>	2.99E-14	3.67E-10
<i>ENSCAFG00000001396</i>	<i>PSMA1</i>	1.38E-11	1.12E-07
<i>ENSCAFG00000024399</i>	<i>COX8A</i>	7.06E-11	4.33E-07
<i>ENSCAFG00000031638</i>	<i>ENSCAFG000</i>	3.27E-09	1.55E-05
<i>ENSCAFG00000015670</i>	<i>PTEN</i>	3.79E-09	1.55E-05
<i>ENSCAFG00000006440</i>	<i>LTA4H</i>	2.73E-08	9.57E-05
<i>ENSCAFG00000000584</i>	<i>ZNF706</i>	6.80E-08	2.08E-04

<i>ENSCAFG00000013551</i>	<i>ATP5H</i>	2.81E-07	7.67E-04
<i>ENSCAFG00000029967</i>	<i>RPLP2</i>	9.15E-07	2.24E-03
<i>ENSCAFG00000005019</i>	<i>GATA3</i>	1.33E-06	2.98E-03
<i>ENSCAFG00000002501</i>	<i>NLRP5</i>	2.14E-06	4.37E-03
<i>ENSCAFG00000014463</i>	<i>PTPN6</i>	2.44E-06	4.59E-03
<i>ENSCAFG00000004229</i>	<i>GLUD2</i>	3.81E-06	5.49E-03
<i>ENSCAFG00000008369</i>	<i>PBK</i>	3.49E-06	5.49E-03
<i>ENSCAFG00000016310</i>	<i>IKZF3</i>	3.62E-06	5.49E-03
<i>ENSCAFG00000013232</i>	<i>RPL11</i>	4.03E-06	5.49E-03
<i>ENSCAFG00000017753</i>	<i>RPL23A</i>	7.22E-06	9.32E-03
<i>ENSCAFG00000030674</i>	<i>FAM90A1</i>	8.35E-06	1.02E-02
<i>ENSCAFG00000017298</i>	<i>MAP2K1</i>	1.39E-05	1.63E-02
<i>ENSCAFG00000029913</i>	<i>ENSCAFG000</i>	1.71E-05	1.90E-02
<i>ENSCAFG00000019029</i>	<i>MAGEC2</i>	2.22E-05	2.26E-02
<i>ENSCAFG00000002232</i>	<i>HNRNPA1L2</i>	2.14E-05	2.26E-02
<i>ENSCAFG00000011017</i>	<i>KRTAP10-6</i>	2.33E-05	2.29E-02