Table S1. Selection of breeds and animals

Breed	Subspecies	Usage	Number	Origin & Feature
Angus	*Bos taurus*	Beef	11	Britain
Beefmaster	Composite*	Beef	1	1/4 Hereford, 1/4 Shorthorn and 1/2 Brahman
Bonsmara	*Bos taurus*	Beef	2	Africa, heat resistance
Brahman	*Bos indicus*	Beef	2	Guzerat, Kankrej, Gir and Nelore are the founders
Brangus	Composite	Beef	2	3/8 Brahman and 5/8 Angus
Charolais	*Bos taurus*	Beef	11	France
Gelbvieh	*Bos taurus*	Dual	8	German
Gir	*Bos indicus*	Dairy	3	West India, heat resistance
Guzerat	*Bos indicus*	Beef	3	Brazil, developed from Kankrej of West India
Hereford	*Bos taurus*	Beef	12	Britain
Holstein	*Bos taurus*	Dairy	3	Netherlands
Limousin	*Bos taurus*	Beef	10	France
N'dama	*Bos taurus*	Dual	3	Africa, heat resistance
Red Angus	*Bos taurus*	Beef	8	Britain
Romosinuano	*Bos taurus*	Beef	2	New World Spanish, heat resistance
Santa Gertrudis	Composite	Beef	1	3/8 Brahman, 5/8 Shorthorn, heat, tick and bloat resistance
Simmental	*Bos taurus*	Dual	8	Switzerland

*Composite: cross breeds between *Bos Taurus* and *Bos indicus*.

Table S2. Btau_4.0 cattle CNV regions and their frequencies.

No	Chr	Begin	End	Length	Type	Count	Frequency
1	chr1	68,909,085	68,973,239	64,154	Gain	1	Unique
2	chr1	123,053,217	123,117,166	63,949	Loss	1	Unique
3	chr2	66,690,000	66,810,000	120,000	Gain	1	Unique
4	chr2	127,971,814	128,000,536	28,722	Loss	2	Multiple
5	chr3	315,000	435,000	120,000	Gain	2	Multiple
6	chr3	9,531,000	9,585,000	54,000	Loss	1	Unique
7	chr3	18,825,000	18,945,000	120,000	Loss	1	Unique
8	chr3	22,509,294	22,547,622	38,328	Gain	1	Unique
9	chr3	22,585,743	22,931,467	345,724	Loss	4	4.44%
10	chr3	24,480,004	24,654,724	174,720	Gain	27	30.00%
11	chr3	57,645,216	58,272,313	627,097	Both	10	11.11%
12	chr3	100,032,093	100,179,000	146,907	Both	30	33.33%
13	chr3	106,104,548	106,190,998	86,450	Gain	1	Unique
14	chr3	127,071,000	127,215,000	144,000	Gain	1	Unique
15	chr4	14,733,000	14,769,000	36,000	Loss	1	Unique
16	chr4	78,021,000	78,165,000	144,000	Loss	1	Unique
17	chr4	95,499,000	95,571,000	72,000	Loss	2	Multiple
18	chr4	108,923,168	108,997,827	74,659	Gain	2	Multiple
19	chr4	109,251,000	109,452,844	201,844	Gain	8	8.89%
20	chr4	109,635,000	109,785,000	150,000	Both	4	4.44%
21	chr4	109,989,000	110,041,842	52,842	Gain	3	3.33%
22	chr4	117,132,698	117,632,250	499,552	Gain	12	13.33%
23	chr4	124,125,000	124,452,651	327,651	Loss	10	11.11%
24	chr5	9,573,920	10,097,114	523,194	Both	9	10.00%
25	chr5	47,673,000	47,853,000	180,000	Both	3	3.33%
26	chr5	53,869,979	53,910,107	40,128	Loss	1	Unique
27	chr5	62,244,817	62,661,498	416,681	Loss	5	5.56%
28	chr5	63,165,587	63,562,388	396,801	Loss	13	14.44%
29	chr5	63,579,687	63,999,368	419,681	Loss	3	3.33%
30	chr5	107,539,920	107,614,568	74,648	Gain	2	Multiple
31	chr5	109,377,000	110,054,555	677,555	Both	8	8.89%
32	chr6	5,485,080	5,862,492	377,412	Both	4	4.44%
33	chr6	6,345,000	6,669,000	324,000	Loss	1	Unique
34	chr6	6,765,026	6,790,769	25,743	Loss	1	Unique
35	chr6	63,687,737	63,878,973	191,236	Gain	16	17.78%
36	chr6	70,191,000	70,227,000	36,000	Loss	1	Unique
37	chr6	85,581,296	85,683,604	102,308	Loss	1	Unique
38	chr7	4,851,208	4,908,843	57,635	Gain	1	Unique
39	chr7	7,857,000	7,942,406	85,406	Loss	5	5.56%
40	chr7	12,352,707	12,481,414	128,707	Loss	1	Unique

41	chr7	15,810,000	15,870,000	60,000	Loss	1	Unique
42	chr7	22,455,307	22,489,586	34,279	Gain	1	Unique
43	chr7	67,686,516	67,738,270	51,754	Gain	11	12.22%
44	chr7	68,063,725	68,149,918	86,193	Loss	1	Unique
45	chr7	76,922,064	77,415,000	492,936	Loss	10	11.11%
46	chr8	12,105,000	12,225,000	120,000	Loss	1	Unique
47	chr8	12,717,168	12,774,565	57,397	Loss	9	10.00%
48	chr8	23,596,847	23,661,011	64,164	Gain	1	Unique
49	chr8	24,482,455	24,697,905	215,450	Both	2	Multiple
50	chr8	54,138,485	54,173,003	34,518	Loss	1	Unique
51	chr8	62,745,000	62,925,000	180,000	Gain	1	Unique
52	chr8	73,260,000	73,918,191	658,191	Both	4	4.44%
53	chr8	79,263,000	79,299,000	36,000	Loss	1	Unique
54	chr8	108,813,293	108,909,000	95,707	Gain	7	7.78%
55	chr9	87,760,186	87,850,164	89,978	Gain	2	Multiple
56	chr9	90,171,000	90,490,021	319,021	Both	29	32.22%
57	chr9	94,080,422	94,112,458	32,036	Gain	1	Unique
58	chr10	1,017,988	1,075,693	57,705	Loss	1	Unique
59	chr10	23,295,000	24,556,895	1,261,895	Both	31	34.44%
60	chr10	95,729,455	95,763,933	34,478	Loss	1	Unique
61	chr10	96,550,404	96,642,354	91,950	Loss	1	Unique
62	chr10	106,140,000	106,380,423	240,423	Loss	2	Multiple
63	chr11	48,849,102	49,010,021	160,919	Loss	1	Unique
64	chr11	50,949,027	51,017,993	68,966	Loss	3	3.33%
65	chr11	96,563,679	96,723,000	159,321	Loss	24	26.67%
66	chr12	65,895,562	65,924,442	28,880	Loss	1	Unique
67	chr12	69,093,979	69,197,543	103,564	Loss	3	3.33%
68	chr12	69,363,000	69,465,000	102,000	Gain	4	4.44%
69	chr12	69,687,000	69,723,000	36,000	Gain	1	Unique
70	chr12	69,761,628	70,515,700	754,072	Both	38	42.22%
71	chr13	16,725,000	16,815,000	90,000	Gain	1	Unique
72	chr13	54,025,360	54,071,458	46,098	Loss	5	5.56%
73	chr13	63,366,840	63,400,994	34,154	Both	11	12.22%
74	chr14	1,215,000	1,290,000	75,000	Loss	2	Multiple
75	chr14	3,750,000	3,810,000	60,000	Gain	1	Unique
76	chr14	9,401,744	9,452,912	51,168	Loss	1	Unique
77	chr14	12,877,707	13,359,578	481,871	Both	39	43.33%
78	chr14	75,705,000	75,735,000	30,000	Loss	1	Unique
79	chr14	78,821,029	78,884,395	63,366	Loss	1	Unique
80	chr14	81,254,738	81,293,107	38,369	Gain	1	Unique
81	chr15	6,496,329	6,651,000	154,671	Loss	18	20.00%
82	chr15	15,825,000	16,125,000	300,000	Loss	3	3.33%
83	chr15	44,987,111	45,300,000	312,889	Gain	8	8.89%

84	chr15	46,323,510	46,755,000	431,490	Loss	5	5.56%
85	chr15	47,227,108	47,301,726	74,618	Gain	2	Multiple
86	chr15	48,070,457	48,153,976	83,519	Loss	1	Unique
87	chr15	48,339,579	48,378,056	38,477	Loss	1	Unique
88	chr15	49,140,000	49,260,000	120,000	Gain	1	Unique
89	chr15	50,145,000	50,235,000	90,000	Loss	1	Unique
90	chr15	50,913,000	51,021,250	108,250	Both	17	18.89%
91	chr15	79,557,444	80,205,079	647,635	Loss	7	7.78%
92	chr15	82,809,000	83,078,466	269,466	Gain	11	12.22%
93	chr15	83,259,000	83,468,937	209,937	Both	13	14.44%
94	chr16	4,000,311	4,230,000	229,689	Gain	5	5.56%
95	chr16	76,838,846	76,864,284	25,438	Loss	1	Unique
96	chr17	7,213,847	7,254,139	40,292	Loss	1	Unique
97	chr17	42,057,000	42,075,000	18,000	Loss	1	Unique
98	chr17	72,977,869	73,029,732	51,863	Gain	1	Unique
99	chr17	74,025,000	74,115,000	90,000	Loss	3	3.33%
100	chr17	74,238,123	74,413,301	175,178	Gain	36	40.00%
101	chr18	12,576,378	12,659,415	83,037	Gain	1	Unique
102	chr18	50,301,000	50,553,518	252,518	Loss	3	3.33%
103	chr18	51,135,000	51,193,880	58,880	Gain	19	21.11%
104	chr18	57,092,062	57,270,472	178,410	Gain	49	54.44%
105	chr18	58,055,777	58,141,831	86,054	Gain	1	Unique
106	chr18	59,201,149	59,224,119	22,970	Loss	1	Unique
107	chr18	60,243,680	60,281,875	38,195	Gain	1	Unique
108	chr18	61,376,379	61,498,031	121,652	Gain	5	5.56%
109	chr18	61,638,721	61,893,000	254,279	Both	20	22.22%
110	chr18	63,405,000	63,513,000	108,000	Both	6	6.67%
111	chr18	63,828,576	63,869,067	40,491	Loss	1	Unique
112	chr19	3,483,000	3,537,000	54,000	Gain	1	Unique
113	chr19	4,608,304	4,672,381	64,077	Loss	1	Unique
114	chr19	4,755,000	4,785,000	30,000	Loss	1	Unique
115	chr19	8,265,000	8,325,000	60,000	Loss	1	Unique
116	chr19	24,090,072	24,115,440	25,368	Loss	1	Unique
117	chr19	27,603,000	27,747,000	144,000	Loss	2	Multiple
118	chr19	53,649,000	53,793,000	144,000	Gain	1	Unique
119	chr19	65,211,819	65,246,162	34,343	Loss	1	Unique
120	chr20	55,851,900	55,984,013	132,113	Loss	1	Unique
121	chr20	68,472,375	68,552,865	80,490	Loss	1	Unique
122	chr21	1,635,000	1,875,000	240,000	Gain	1	Unique
123	chr21	19,269,000	19,417,803	148,803	Loss	3	3.33%
124	chr21	19,470,000	19,650,000	180,000	Gain	1	Unique
125	chr21	59,625,000	59,685,000	60,000	Gain	1	Unique
126	chr22	9,150,000	9,390,000	240,000	Loss	1	Unique

127	chr22	19,251,000	19,287,000	36,000	Loss	1	Unique
128	chr22	35,325,000	35,469,000	144,000	Loss	2	Multiple
129	chr22	36,320,501	36,396,810	76,309	Loss	1	Unique
130	chr23	26,073,638	26,355,693	282,055	Loss	56	62.22%
131	chr23	26,565,000	26,655,000	90,000	Both	2	Multiple
132	chr23	27,744,327	27,891,680	147,353	Loss	7	7.78%
133	chr23	28,504,283	28,573,172	68,889	Loss	1	Unique
134	chr23	28,971,000	29,026,339	55,339	Loss	8	8.89%
135	chr23	29,145,000	29,235,000	90,000	Both	3	3.33%
136	chr24	6,823,277	6,906,090	82,813	Loss	7	7.78%
137	chr24	26,669,244	26,694,642	25,398	Loss	1	Unique
138	chr24	45,711,000	45,747,000	36,000	Loss	1	Unique
139	chr24	64,965,000	64,991,956	26,956	Loss	2	Multiple
140	chr25	25,857	454,413	428,556	Gain	3	3.33%
141	chr25	10,598,689	10,643,298	44,609	Gain	2	Multiple
142	chr26	882,118	922,348	40,230	Loss	1	Unique
143	chr26	12,705,000	12,765,000	60,000	Loss	1	Unique
144	chr26	21,177,000	21,213,000	36,000	Gain	1	Unique
145	chr26	23,760,478	23,805,000	44,522	Gain	2	Multiple
146	chr26	34,433,100	34,473,291	40,191	Loss	1	Unique
147	chr26	43,014,415	43,078,689	64,274	Both	2	Multiple
148	chr27	6,246,785	6,335,838	89,053	Gain	6	6.67%
149	chr27	6,543,000	7,366,579	823,579	Both	14	15.56%
150	chr27	11,535,000	11,603,667	68,667	Loss	3	3.33%
151	chr27	22,390,857	22,436,741	45,884	Loss	1	Unique
152	chr27	37,323,000	37,395,000	72,000	Loss	4	4.44%
153	chr27	47,518,239	47,610,233	91,994	Loss	1	Unique
154	chr28	12,699,849	12,740,102	40,253	Loss	1	Unique
155	chr28	17,847,000	17,901,000	54,000	Loss	1	Unique
156	chr28	44,610,000	44,670,000	60,000	Loss	1	Unique
157	chr29	15,000	165,000	150,000	Loss	1	Unique
158	chr29	2,355,264	2,573,057	217,793	Loss	20	22.22%
159	chr29	5,543,215	5,811,455	268,240	Gain	27	30.00%
160	chr29	13,110,000	13,170,000	60,000	Gain	1	Unique
161	chr29	19,152,512	19,175,571	23,059	Loss	1	Unique
162	chr29	38,349,104	38,541,000	191,896	Gain	3	3.33%
163	chr29	43,545,656	43,630,741	85,085	Gain	2	Multiple
164	chrX	8,901,000	8,991,000	90,000	Gain	1	Unique
165	chrX	24,217,610	24,774,856	557,246	Loss	19	21.11%
166	chrX	27,351,000	27,477,000	126,000	Loss	1	Unique
167	chrX	31,910,755	32,083,616	172,861	Loss	25	27.78%
168	chrX	33,694,648	33,792,426	97,778	Loss	1	Unique
169	chrX	34,361,990	34,400,145	38,155	Loss	3	3.33%

170	chrX	36,963,000	37,251,000	288,000	Loss	9	10.00%
171	chrX	42,705,000	42,765,000	60,000	Loss	1	Unique
172	chrX	48,263,962	48,339,720	75,758	Loss	1	Unique
173	chrX	60,781,101	60,838,583	57,482	Loss	2	Multiple
174	chrX	70,876,874	71,036,203	159,329	Loss	2	Multiple
175	chrX	72,976,320	73,010,880	34,560	Loss	1	Unique
176	chrX	76,650,000	76,770,000	120,000	Loss	1	Unique
177	chrX	83,690,311	84,900,000	1,209,689	Both	18	20.00%
178	chrUnAll	9,971,371	13,095,000	3,123,629	Loss	25	27.78%
179	chrUnAll	40,179,520	40,743,443	563,923	Loss	4	4.44%
180	chrUnAll	41,325,000	41,922,291	597,291	Loss	11	12.22%
181	chrUnAll	49,008,347	49,307,484	299,137	Gain	4	4.44%
182	chrUnAll	53,326,808	53,505,147	178,339	Loss	2	Multiple
183	chrUnAll	54,915,713	54,956,016	40,303	Loss	1	Unique
184	chrUnAll	56,979,204	57,420,972	441,768	Gain	3	3.33%
185	chrUnAll	63,942,774	64,160,222	217,448	Gain	1	Unique
186	chrUnAll	69,669,000	71,047,470	1,378,470	Both	19	21.11%
187	chrUnAll	74,019,184	74,409,430	390,246	Gain	1	Unique
188	chrUnAll	75,267,000	75,565,214	298,214	Gain	2	Multiple
189	chrUnAll	76,208,831	76,501,606	292,775	Loss	4	4.44%
190	chrUnAll	77,081,786	77,388,934	307,148	Loss	7	7.78%
191	chrUnAll	79,260,000	81,180,000	1,920,000	Gain	5	5.56%
192	chrUnAll	81,463,507	81,825,730	362,223	Loss	4	4.44%
193	chrUnAll	83,370,000	83,905,472	535,472	Gain	10	11.11%
194	chrUnAll	85,392,617	85,507,596	114,979	Gain	1	Unique
195	chrUnAll	88,173,000	88,299,000	126,000	Loss	1	Unique
196	chrUnAll	94,581,000	95,308,906	727,906	Gain	40	44.44%
197	chrUnAll	95,321,847	95,533,052	211,205	Loss	1	Unique
198	chrUnAll	95,790,000	96,990,000	1,200,000	Gain	8	8.89%
199	chrUnAll	98,473,861	98,713,945	240,084	Loss	1	Unique
200	chrUnAll	102,291,656	102,459,658	168,002	Gain	3	3.33%
201	chrUnAll	108,146,086	108,267,346	121,260	Loss	1	Unique
202	chrUnAll	109,107,000	109,619,203	512,203	Loss	13	14.44%
203	chrUnAll	110,109,749	110,376,110	266,361	Loss	1	Unique
204	chrUnAll	111,743,430	111,864,176	120,746	Loss	1	Unique
205	chrUnAll	112,992,219	113,132,819	140,600	Loss	2	Multiple
206	chrUnAll	116,998,564	117,126,749	128,185	Loss	1	Unique
207	chrUnAll	121,332,693	121,476,233	143,540	Gain	1	Unique
208	chrUnAll	121,491,718	121,637,270	145,552	Loss	2	Multiple
209*	chrUnAll	130,132,172	130,488,613	356,441	Loss	55	61.11%
210	chrUnAll	131,808,346	132,051,527	243,181	Loss	2	Multiple
211	chrUnAll	134,470,553	134,521,617	51,064	Loss	1	Unique
212	chrUnAll	142,329,709	142,425,926	96,217	Loss	2	Multiple

213	chrUnAll	146,655,278	146,792,865	137,587	Loss	6	6.67%
214	chrUnAll	147,822,392	147,909,433	87,041	Loss	1	Unique
215*	chrUnAll	164,064,002	164,699,372	635,370	Both	50	55.56%
216	chrUnAll	172,016,100	172,072,676	56,576	Loss	1	Unique
217*	chrUnAll	173,853,000	173,925,000	72,000	Gain	84	93.33%
218	chrUnAll	178,635,000	179,340,935	705,935	Gain	25	27.78%
219	chrUnAll	180,943,605	180,983,898	40,293	Gain	1	Unique
220	chrUnAll	200,744,054	200,778,537	34,483	Loss	1	Unique
221	chrUnAll	201,502,327	201,537,025	34,698	Gain	1	Unique
222	chrUnAll	202,605,000	202,653,000	48,000	Gain	19	21.11%
223	chrUnAll	213,634,012	213,657,067	23,055	Loss	1	Unique
224	chrUnAll	216,841,603	217,019,916	178,313	Loss	2	Multiple
225	chrUnAll	225,568,273	225,709,228	140,955	Loss	15	16.67%
226	chrUnAll	231,703,064	231,777,734	74,670	Loss	3	3.33%
227†	chrUnAll	256,383,000	256,707,000	324,000	Gain	2	Multiple
228†	chrUnAll	328,515,000	329,115,000	600,000	Gain	1	Unique
229†	chrUnAll	355,293,000	355,617,000	324,000	Gain	1	Unique

*Potential chrY origins; † comprise of concatenated multiple short contigs of which each is 3-20 kb in length.

Table S3. Comparison of CNV regions identified on two cattle genome assemblies.

Statistics	Btau_4.0	UMD3
CNVR Count	223	224
Loss	127	135
Gain	70	63
Both	24	26
Total Length	45,413,581	47,545,478
Minimum Length	18,000	10,629
Maximum Length	3,123,629	2,791,266
Average Length	203,648	212,257
Standard Deviation	316,126	354,133
Median Length	102,000	90,000

Table S4. UMD3 cattle CNV regions.

No	Chr	Begin	End	Length	Type
1	chr1	12,404,332	12,528,578	124,246	Loss
2	chr1	33,208,276	33,248,277	40,001	Loss
3	chr1	68,406,689	68,471,424	64,735	Gain
4	chr1	93,715,994	93,843,000	127,006	Gain
5	chr1	121,830,338	121,898,744	68,406	Loss
6	chr1	151,136,691	151,168,420	31,729	Loss
7	chr2	124,177,138	124,242,373	65,235	Loss
8	chr2	124,316,758	124,376,024	59,266	Loss
9	chr2	133,155,000	133,185,000	30,000	Gain
10	chr2	136,737,000	137,045,723	308,723	Loss
11	chr3	8,521,887	8,775,000	253,113	Loss
12	chr3	11,751,815	11,966,581	214,766	Loss
13	chr3	17,624,821	17,677,445	52,624	Loss
14	chr3	20,955,923	20,994,243	38,320	Gain
15	chr3	22,735,805	22,899,765	163,960	Gain
16	chr3	54,405,000	54,891,000	486,000	Loss
17	chr3	54,927,000	55,032,639	105,639	Loss
18	chr3	93,896,074	94,046,726	150,652	Both
19	chr4	6,695	118,572	111,877	Both
20	chr4	75,017,419	75,142,030	124,611	Loss
21	chr4	93,105,000	93,141,000	36,000	Loss
22	chr4	99,784,680	99,909,797	125,117	Gain
23	chr4	106,065,000	106,119,000	54,000	Gain
24	chr4	106,365,391	106,536,801	171,410	Gain
25	chr4	106,635,000	106,770,000	135,000	Loss
26	chr4	113,648,571	114,140,773	492,202	Gain
27	chr5	22,527,000	22,599,000	72,000	Gain
28	chr5	44,409,847	44,538,061	128,214	Both
29	chr5	50,031,359	50,069,134	37,775	Loss
30	chr5	58,005,538	58,422,588	417,050	Loss
31	chr5	58,923,000	59,321,950	398,950	Loss
32	chr5	59,339,327	59,654,810	315,483	Loss
33	chr5	68,909,700	68,947,795	38,095	Gain
34	chr5	100,559,139	100,633,223	74,084	Gain
35	chr5	102,438,969	102,531,866	92,897	Loss
36	chr5	102,583,121	102,625,698	42,577	Loss
37	chr5	103,089,467	103,471,766	382,299	Both
38	chr5	117,267,709	117,641,661	373,952	Both
39	chr6	5,306,380	6,618,148	1,311,768	Both
40	chr6	48,812,842	48,877,955	65,113	Loss
41	chr6	49,826,925	49,852,261	25,336	Loss
42	chr6	62,752,542	62,985,000	232,458	Gain
43	chr6	71,670,000	71,730,000	60,000	Loss
44	chr6	84,631,233	84,733,458	102,225	Loss
45	chr7	9,765,000	9,916,610	151,610	Loss
46	chr7	11,565,000	12,160,765	595,765	Gain
47	chr7	15,090,078	15,179,076	88,998	Loss
48	chr7	18,531,000	18,557,958	26,958	Loss

49	chr7	22,329,000	22,413,851	84,851	Gain
50	chr7	44,163,000	44,541,000	378,000	Both
51	chr7	52,605,000	52,641,000	36,000	Loss
52	chr7	70,176,836	70,279,307	102,471	Loss
53	chr7	79,107,779	79,274,921	167,142	Gain
54	chr8	11,895,000	11,985,000	90,000	Loss
55	chr8	12,440,343	12,501,000	60,657	Loss
56	chr8	22,593,989	22,638,552	44,563	Gain
57	chr8	23,168,355	23,236,018	67,663	Loss
58	chr8	52,094,543	52,129,045	34,502	Loss
59	chr8	70,845,000	70,935,000	90,000	Loss
60	chr8	96,133,104	96,184,377	51,273	Loss
61	chr8	105,151,217	105,291,000	139,783	Gain
62	chr9	7,695,000	7,935,000	240,000	Gain
63	chr9	25,515,000	25,551,000	36,000	Gain
64	chr9	30,508,899	30,522,305	13,406	Loss
65	chr9	49,991,763	50,092,508	100,745	Gain
66	chr9	88,190,581	88,329,930	139,349	Both
67	chr10	1,518,205	1,575,631	57,426	Loss
68	chr10	22,618,325	22,667,220	48,895	Gain
69	chr10	23,140,774	23,769,000	628,226	Loss
70	chr10	23,790,000	25,230,000	1,440,000	Both
71	chr10	27,640,799	27,660,108	19,309	Loss
72	chr10	95,166,564	95,257,610	91,046	Loss
73	chr11	44,925,000	45,015,000	90,000	Gain
74	chr11	47,013,979	47,111,925	97,946	Loss
75	chr11	49,055,306	49,098,274	42,968	Loss
76	chr11	69,363,000	69,453,000	90,000	Loss
77	chr11	86,009,440	86,036,890	27,450	Loss
78	chr11	93,429,000	93,627,000	198,000	Loss
79	chr11	99,343,461	99,405,000	61,539	Loss
80	chr11	104,214,593	104,240,571	25,978	Loss
81	chr11	104,931,000	105,164,204	233,204	Loss
82	chr12	6,929	35,719	28,790	Loss
83	chr12	13,402,578	13,437,116	34,538	Loss
84	chr12	32,025,000	32,205,000	180,000	Loss
85	chr12	65,253,198	65,421,000	167,802	Loss
86	chr12	70,378,149	70,487,773	109,624	Loss
87	chr12	71,045,530	72,243,000	1,197,470	Loss
88	chr12	72,433,734	75,225,000	2,791,266	Both
89	chr12	75,484,664	76,743,000	1,258,336	Both
90	chr13	5,312,800	5,592,236	279,436	Gain
91	chr13	9,608,670	9,660,384	51,714	Loss
92	chr13	9,847,219	9,900,360	53,141	Loss
93	chr13	11,010,000	11,490,000	480,000	Gain
94	chr13	17,834,349	17,877,889	43,540	Gain
95	chr13	43,641,000	43,810,694	169,694	Loss
96	chr13	53,936,899	53,982,997	46,098	Loss
97	chr13	63,030,306	63,060,638	30,332	Both
98	chr14	5,579	1,116,501	1,110,922	Gain

99	chr14	2,709,000	2,745,000	36,000	Loss
100	chr14	14,506,703	15,482,801	976,098	Loss
101	chr14	79,160,768	79,231,505	70,737	Loss
102	chr14	84,546,009	84,585,145	39,136	Gain
103	chr15	9,000	45,000	36,000	Gain
104	chr15	29,547,745	29,651,004	103,259	Loss
105	chr15	45,477,000	45,531,000	54,000	Loss
106	chr15	46,554,431	46,610,628	56,197	Gain
107	chr15	46,665,000	46,755,000	90,000	Gain
108	chr15	46,837,290	46,991,953	154,663	Gain
109	chr15	47,817,000	47,943,000	126,000	Loss
110	chr15	49,865,747	49,950,692	84,945	Loss
111	chr15	50,679,000	50,888,018	209,018	Both
112	chr15	52,209,000	52,300,235	91,235	Loss
113	chr15	57,222,118	57,234,793	12,675	Loss
114	chr15	79,566,457	79,635,991	69,534	Loss
115	chr15	80,343,978	81,030,057	686,079	Both
116	chr15	81,045,000	81,081,000	36,000	Loss
117	chr15	81,837,000	81,945,000	108,000	Loss
118	chr15	83,426,017	83,505,835	79,818	Gain
119	chr15	83,710,830	83,943,000	232,170	Both
120	chr16	6,870,000	7,650,000	780,000	Loss
121	chr16	8,412,244	8,425,579	13,335	Gain
122	chr16	15,078,404	15,104,696	26,292	Loss
123	chr16	65,101,580	65,153,297	51,717	Loss
124	chr16	70,845,000	70,995,000	150,000	Loss
125	chr17	25,031,276	25,131,170	99,894	Gain
126	chr17	35,643,052	36,164,221	521,169	Gain
127	chr17	50,589,000	51,060,000	471,000	Gain
128	chr17	51,115,949	52,094,211	978,262	Gain
129	chr17	72,958,351	73,042,968	84,617	Gain
130	chr18	16,624	40,181	23,557	Gain
131	chr18	13,365,000	13,425,000	60,000	Gain
132	chr18	45,315,000	45,345,000	30,000	Loss
133	chr18	50,883,145	51,123,848	240,703	Loss
134	chr18	51,741,000	51,798,945	57,945	Gain
135	chr18	57,598,919	57,761,618	162,699	Gain
136	chr18	59,644,156	59,665,926	21,770	Loss
137	chr18	60,412,306	60,518,325	106,019	Gain
138	chr18	61,569,000	61,955,971	386,971	Both
139	chr18	63,491,266	63,589,198	97,932	Both
140	chr19	4,563,000	4,617,000	54,000	Gain
141	chr19	16,004,892	16,030,684	25,792	Loss
142	chr19	19,782,449	19,965,000	182,551	Both
143	chr19	35,883,000	35,985,000	102,000	Gain
144	chr19	64,004,873	64,039,216	34,343	Loss
145	chr20	64,806,091	64,887,253	81,162	Loss
146	chr20	67,221,883	67,248,553	26,670	Loss
147	chr21	1,323,000	1,467,000	144,000	Gain
148	chr21	20,055,000	20,189,594	134,594	Both

149	chr21	20,653,466	20,688,757	35,291	Gain
150	chr22	9,165,000	9,435,000	270,000	Loss
151	chr22	33,108,620	33,174,532	65,912	Loss
152	chr22	34,623,000	34,911,000	288,000	Loss
153	chr22	35,669,459	35,745,755	76,296	Loss
154	chr22	39,699,000	40,098,279	399,279	Both
155	chr23	25,310,179	25,515,000	204,821	Loss
156	chr23	25,707,434	26,415,000	707,566	Both
157	chr23	26,460,000	26,595,000	135,000	Loss
158	chr23	27,653,986	27,755,698	101,712	Loss
159	chr23	28,440,660	28,472,772	32,112	Loss
160	chr23	28,532,569	28,543,198	10,629	Gain
161	chr23	28,790,089	28,875,490	85,401	Loss
162	chr23	29,043,000	29,115,000	72,000	Loss
163	chr23	29,715,000	29,745,000	30,000	Loss
164	chr23	29,790,261	29,811,178	20,917	Loss
165	chr24	3,468	137,146	133,678	Loss
166	chr24	6,845,019	6,939,000	93,981	Loss
167	chr24	25,898,770	25,924,168	25,398	Loss
168	chr24	62,343,261	62,429,278	86,017	Both
169	chr24	62,655,000	62,701,092	46,092	Loss
170	chr25	1,110,227	1,139,149	28,922	Loss
171	chr25	6,255,000	6,285,000	30,000	Loss
172	chr25	9,615,550	9,680,745	65,195	Gain
173	chr25	19,395,411	19,528,165	132,754	Gain
174	chr25	27,230,639	27,278,213	47,574	Gain
175	chr25	33,059,912	33,123,933	64,021	Gain
176	chr26	874,878	915,108	40,230	Loss
177	chr26	2,079,000	2,115,000	36,000	Loss
178	chr26	2,985,000	3,015,000	30,000	Loss
179	chr26	3,496,876	3,509,267	12,391	Loss
180	chr26	23,647,739	23,696,504	48,765	Gain
181	chr26	34,257,546	34,297,185	39,639	Loss
182	chr26	42,793,718	42,829,204	35,486	Loss
183	chr26	51,651,000	51,668,830	17,830	Gain
184	chr27	5,460,000	6,231,876	771,876	Both
185	chr27	6,453,000	6,525,000	72,000	Loss
186	chr27	10,060,926	10,073,519	12,593	Loss
187	chr27	12,933,000	12,969,000	36,000	Loss
188	chr27	40,671,605	40,757,906	86,301	Loss
189	chr28	333,000	423,000	90,000	Loss
190	chr28	2,462,403	2,878,122	415,719	Loss
191	chr28	10,442,953	10,483,087	40,134	Gain
192	chr28	14,097,387	14,137,651	40,264	Loss
193	chr28	20,844,925	20,896,564	51,639	Loss
194	chr28	28,885,586	28,914,313	28,727	Loss
195	chr28	43,065,000	43,125,000	60,000	Gain
196	chr29	5,437,778	5,805,000	367,222	Gain
197	chr29	15,741,000	15,759,000	18,000	Loss
198	chr29	18,299,851	18,322,907	23,056	Loss

199	chr29	37,215,000	37,365,000	150,000	Gain
200	chr29	42,453,738	42,583,261	129,523	Both
201	chrX	4,208,736	4,395,000	186,264	Loss
202	chrX	5,059,729	5,233,607	173,878	Both
203	chrX	10,476,177	10,687,727	211,550	Loss
204	chrX	18,975,000	19,125,000	150,000	Loss
205	chrX	35,633,452	38,170,292	2,536,840	Loss
206	chrX	39,120,213	39,314,880	194,667	Gain
207	chrX	40,825,261	40,878,073	52,812	Loss
208	chrX	53,835,000	54,405,000	570,000	Loss
209	chrX	56,025,581	56,788,203	762,622	Loss
210	chrX	58,041,000	58,491,000	450,000	Both
211	chrX	63,605,651	64,521,000	915,349	Loss
212	chrX	65,611,894	65,655,323	43,429	Loss
213	chrX	84,069,000	84,393,000	324,000	Loss
214	chrX	89,982,017	90,047,104	65,087	Loss
215	chrX	94,545,000	95,385,000	840,000	Loss
216	chrX	118,594,798	119,547,000	952,202	Loss
217	chrX	126,091,341	126,125,903	34,562	Loss
218	chrX	137,097,000	137,325,000	228,000	Loss
219	chrX	137,505,000	138,038,512	533,512	Loss
220	chrX	138,332,777	138,540,191	207,414	Loss
221	chrX	139,170,000	139,432,032	262,032	Loss
222	chrX	142,499,091	142,715,159	216,068	Gain
223	chrX	143,051,142	144,459,000	1,407,858	Gain
224*	chrUnAll	150,000	13,110,000	12,960,000	Gain
225	chrUnAll	16,171,529	16,227,000	55,471	Gain
226*	chrUnAll	25,950,000	26,250,000	300,000	Gain
227*	chrUnAll	29,850,000	30,150,000	300,000	Loss

* comprise of concatenated multiple short contigs of which each is 3-20 kb in length.

Table S5. Btau_4.0 nonredundant measure of cattle CNV and SD sequence by chromosome.

Chromosome		CNV			SD	
Name	**Size**	**Count**	**Bases**	**Fraction**	**Bases**	**Fraction**
chr1	161,106,243	2	128,105	0.08%	890,015	0.55%
chr2	140,800,416	2	148,724	0.11%	505,522	0.36%
chr3	127,923,604	10	1,857,236	1.45%	3,496,320	2.73%
chr4	124,454,208	9	1,558,557	1.25%	1,885,311	1.51%
chr5	125,847,759	8	2,728,696	2.17%	4,261,448	3.39%
chr6	122,561,022	6	1,056,705	0.86%	1,357,434	1.11%
chr7	112,078,216	8	996,918	0.89%	1,395,058	1.24%
chr8	116,942,821	9	1,461,436	1.25%	2,437,740	2.08%
chr9	108,145,351	3	441,038	0.41%	1,030,154	0.95%
chr10	106,383,598	5	1,686,456	1.59%	2,499,539	2.35%
chr11	110,171,769	3	389,209	0.35%	957,384	0.87%
chr12	85,358,539	5	1,024,521	1.20%	951,597	1.11%
chr13	84,419,198	3	170,255	0.20%	1,832,699	2.17%
chr14	81,345,643	7	799,781	0.98%	965,056	1.19%
chr15	84,633,453	13	2,840,965	3.36%	2,548,893	3.01%
chr16	77,906,053	2	255,129	0.33%	1,269,471	1.63%
chr17	76,506,943	5	375,338	0.49%	686,245	0.90%
chr18	66,141,439	11	1,244,497	1.88%	3,140,374	4.75%
chr19	65,312,493	8	555,796	0.85%	1,186,273	1.82%
chr20	75,796,353	2	212,605	0.28%	356,560	0.47%
chr21	69,173,390	4	628,807	0.91%	1,355,393	1.96%
chr22	61,848,140	4	496,313	0.80%	268,420	0.43%
chr23	53,376,148	6	733,642	1.37%	1,607,978	3.01%
chr24	65,020,233	4	171,171	0.26%	571,147	0.88%
chr25	44,060,403	2	473,167	1.07%	752,857	1.71%
chr26	51,750,746	6	285,223	0.55%	820,343	1.59%
chr27	48,749,334	6	1,191,183	2.44%	1,880,223	3.86%
chr28	46,084,206	3	154,256	0.33%	421,128	0.91%
chr29	51,998,940	7	996,080	1.92%	1,748,874	3.36%
chrX	88,516,663	14	3,086,872	3.49%	6,092,914	6.88%
chrUnAll	402,224,868	52	19,576,940	4.87%	45,235,134	11.25%
Total	3,036,638,192	229	47,725,621	1.57%	94,407,504	3.11%
Placed*	2,634,413,324	177	28,148,681	1.07%	49,172,370	1.87%

*Placed excludes chrUnAll.

Table S6. qPCR primer and probe sequence information.

Name	Btau_4.0				Btau_3.1			
	Chr	Strand	Start	End	Chr	Strand	Start	End
Control3_F	5	+	63,131,027	63,131,050	5	+	57,034,288	57,034,311
Control3_P	5	+	63,131,055	63,131,078	5	+	57,034,316	57,034,339
Control3_R	5	-	63,131,225	63,131,247	5	-	57,034,486	57,034,508
OR_1F	5	+	63,412,974	63,412,997	5	+	57,316,235	57,316,258
OR_1P	5	-	63,413,136	63,413,160	5	-	57,316,397	57,316,421
OR_1R	5	-	63,413,164	63,413,188	5	-	57,316,425	57,316,449
OR_2F	5	+	63,264,043	63,264,068	5	+	57,167,304	57,167,329
OR_2R	5	-	63,264,266	63,264,289	5	-	57,167,527	57,167,550
OR_3F	5	+	63,476,600	63,476,625	5	+	57,379,861	57,379,886
OR_3R	5	-	63,476,789	63,476,816	5	-	57,380,050	57,380,077
ULBP_1F	9	+	90,301,327	90,301,347	9	+	79,447,575	79,447,595
ULBP_1R	9	-	90,301,721	90,301,741	9	-	79,447,969	79,447,989
ULBP_2F	9	+	90,306,876	90,306,896	9	+	79,453,124	79,453,144
ULBP_2R	9	-	90,307,239	90,307,260	9	-	79,453,487	79,453,508
ABCC4_1F	12	-	70,155,636	70,155,653	12	-	67,700,664	67,700,687
ABCC4_1R	12	+	70,155,465	70,155,488	12	+	67,700,499	67,700,516
ABCC4_1P	12	+	70,155,496	70,155,519	12	-	67,700,633	67,700,656
ABCC4_2F	12	-	69,988,883	69,988,906	12	+	67,867,246	67,867,269
ABCC4_2R	12	-	69,988,851	69,988,874	12	+	67,867,278	67,867,301
BSP30A_1F	13	+	63,401,606	63,401,626	13	+	61,410,815	61,410,835
BSP30A_1R	13	-	63,401,829	63,401,851	13	-	61,411,038	61,411,060
BSP30A_2F	13	+	63,383,776	63,383,796	13	+	61,392,985	61,393,005
BSP30A_2R	13	-	63,383,922	63,383,943	13	-	61,393,131	61,393,152
Chr14_F	14	-	13,102,868	13,102,890	14	+	12,937,400	12,937,422
Chr14_P	14	+	13,102,766	13,102,789	14	-	12,937,501	12,937,524
Chr14_R	14	+	13,102,739	13,102,758	14	-	12,937,532	12,937,551
ZNF_1F	18	-	57,189,954	57,189,975	18	+	54,774,560	54,774,581
ZNF_1R	18	+	57,189,861	57,189,881	18	-	54,774,654	54,774,674
ZNF_2F	18	-	57,131,158	57,131,180	18	+	54,833,355	54,833,377
ZNF_2R	18	+	57,130,981	57,131,001	18	-	54,833,534	54,833,554

Table S7. Number of comparative genome hybridization (CGH) probes with significant positive correlations with qPCR data by primer pair.

CNVR No	Chr	Gene and primer pair	Array CGH on Btau_3.1			Array CGH on Btau_4.0		
			Probe No	P < 0.05	P < 0.01	Probe No	P < 0.05	P <0.01
CNVR28	chr5	OR_1	39	12	3	50	21	19
CNVR28	chr5	OR_2	74	15	5	50	22	20
CNVR28	chr5	OR_3	74	0	0	50	22	20
CNVR56	chr9	ULBP_1	10	1	0	32	2	1
CNVR56	chr9	ULBP_2	10	3	1	32	0	0
CNVR70	chr12	ABCC4_1*	289	0	0	161	0	0
CNVR70	chr12	ABCC4_2	289	1	1	161	0	0
CNVR73	chr13	BSP30A_1	5	3	0	4	1	1
CNVR73	chr13	BSP30A_2	5	2	1	4	0	0
CNVR77	chr14		92	2	0	58	1	0
CNVR104	chr18	ZNF_1	37	3	1	57	14	10
CNVR104	chr18	ZNF_2	37	12	9	57	17	1

*The only PCR primer pair which did not correlate with array CGH was ABCC4_1.

Table S8. FISH characterization of predicted CNV regions.

No	Type	BAC	Genomic Coordinates	Cell 1*	Cell 2*	Cell 3*	Support
1	Both	327J13	chr12:69388620-69530289	1	1	1	No change
2	Both	271E1	chr12:69655754-69927836	4	2	NA	Yes
3	Both	259A24	chr17:14989902-15115297	1	1 or 2	2	Yes
4	Both	234E12	chr18:57058249-57236865	2	2	2 or 3*	Yes
5	WGAC	121O22	chr23:26584641-26914146	1	1 or 2*	1 or 2*	Yes
6	Both	203K5	chr23:28827122-29055567	2 or 3*	2	2	Yes
7	WSSD	23F3	chr24:6824971-6986816	1	1	1	No change
8	Both	69N13	chr29:5446868-5554597	2 or 3	2 or 3	2 or 3	Yes
9	Both	70J17	chr3:13022770-13477370	2	2	2	No change
10	Both	143A4	chr3:24373476-24655044	2 or 3	2	1	Yes
11	Both	263E19	chr3:57365022-57692506	2+1#	2+1#	2+1#	No change
12	Both	324F20	chr4:109766054-110035929	2	1	3	Yes
13	Both	461E16	chr4:117307784-117593835	1	1	1	No change
14	Both	343H7	chr5:10034306-10214347	2	1	1	Yes
15	Both	149E13	chr2:136964221-137226534	1	1	1	No change
16	Both	124L13	chr3:9463718-9599665	1	1	1	No change
17	WGAC	490G14	chr4:54337261-54531463	1	1	1	No change
18	CNV	7N20	chr11:96537788-96783462	1	1	1	No change
19	CNV	456G8	chr12:69932838-70069502	2	2	2	No change
20	CNV	259A1	chr12:70157455-70313037	2	3	3	Yes
21	CNV	175G10	chr12:70268832-70475078	2	2	2	No change
22	CNV	503J20	chr13:54004034-54277951	1	1	1	No change
23	CNV	501M13	chr14:1337935-1442910	1	1	1	No change
24	CNV	175F18	chr14:12974392-13175071	2 or 3	2 or 3	2 or 3	No change
25	CNV	2O12	chr14:13091977-13256939	3	2 or 3	2 or 3	Yes
26	CNV	138D7	chr15:15883573-16048209	1 on chrX	1 on chrX	1 on chrX	No change
27	CNV	132D11	chr15:44954318-45191269	1	1	1	No change
28	CNV	73F10	chr15:46040744-46353895	1	1	1	No change
29	CNV	240G20	chr15:46765450-47008471	1	1	1	No change
30	CNV	81B5	chr15:82632034-82915805	1	1	1	No change
31	CNV	446K15	chr16:4019848-4319481	1	2	2	Yes
32	CNV	126B8	chr17:74307216-74527193	1	1	1	No change
33	CNV	429M18	chr18:51054283-51183779	1	1	1	No change
34	CNV	498N9	chr18:61425416-61617511	1 or 2	1 or 2*	1 or 2	Yes
35	CNV	263M20	chr18:61575505-61856243	1	1	2	Yes
36	CNV	392A13	chr18:63400241-63582990	1 or 2	1 or 2	2	Yes
37	CNV	126D18	chr19:27495337-27732170	1 or 2	1 or 2	1 or 2	No change
38	CNV	63C13	chr23:27612770-27903285	1	1	1	No change
39	CNV	223K8	chr25:10519317-10699993	1	1	1	No change

40	CNV	338M16	chr5:109363867-109692177	3	2	2 & 3	Yes
41	CNV	117G16	chr9:90253957-90652236	2	2 & 3	2	Yes

Cell 1 - AG08501: Hereford male smooth muscle cell; Cell 2 - AG08423: Angus female fibroblast and Cell 3 - AG10375: Holstein male fibroblast from Coriell Cell Repositories. *Probably heterozygotes; #Interchromosomic duplication. The results of all FISH experiments are available online at http://bfgl.anri.barc.usda.gov/cattleCNV/.

Table S9. Gene content of cattle CNV regions. See Table S9.xls

Table S10. Over/Underrepresentation of PANTHER molecular function, biological process and pathway terms

	Genome (23415)	CNV (536)	Expected	Over/Under representation	P-value
Molecular Function					
Defense/immunity protein	706	95	16.16	+	4.03E-42
Other receptor	366	54	8.38	+	1.82E-24
Receptor	2862	151	65.51	+	1.01E-21
Major histocompatibility complex antigen	61	21	1.4	+	6.53E-16
Immunoglobulin receptor family member	271	29	6.2	+	2.78E-09
Other defense and immunity protein	137	19	3.14	+	1.47E-07
Large G-protein	74	11	1.69	+	3.28E-04
Molecular function unclassified	5912	172	135.33	+	6.49E-03
G-protein coupled receptor	1538	60	35.21	+	7.66E-03
Antibacterial response protein	71	9	1.63	+	7.86E-03
Nucleic acid binding	2942	28	67.35	-	2.76E-07
Transcription factor	2096	22	47.98	-	3.22E-04
Protease	762	5	17.44	-	1.22E-02
Oxidoreductase	770	6	17.63	-	3.42E-02
Biological Process					
Immunity and defense	1912	160	43.77	+	1.20E-46
Macrophage-mediated immunity	207	43	4.74	+	6.69E-25
T-cell mediated immunity	349	51	7.99	+	6.82E-23
MHCII-mediated immunity	34	11	0.78	+	1.41E-07
MHCI-mediated immunity	36	11	0.82	+	2.54E-07
Other oncogenesis	103	15	2.36	+	4.13E-06
Natural killer cell mediated immunity	120	16	2.75	+	4.76E-06
Interferon-mediated immunity	80	11	1.83	+	4.95E-04
Chemosensory perception	1073	49	24.56	+	7.31E-04
Olfaction	1063	49	24.33	+	7.78E-04
Sensory perception	1457	58	33.35	+	1.15E-03
Protein ADP-ribosylation	19	6	0.43	+	1.25E-03
G-protein mediated signaling	1891	72	43.29	+	3.42E-03
Extracellular transport and import	159	14	3.64	+	3.74E-03
Pheromone response	46	7	1.05	+	1.61E-02
Nucleoside, nucleotide and nucleic acid metabolism	3590	30	82.18	-	5.57E-11
Developmental processes	2390	17	54.71	-	1.79E-08
Protein metabolism and modification	3406	35	77.97	-	1.67E-07
Intracellular protein traffic	1138	5	26.05	-	1.20E-05
Cell cycle	1078	5	24.68	-	3.85E-05
Protein modification	1318	8	30.17	-	1.61E-04
mRNA transcription	1972	20	45.14	-	1.67E-03
Pathway					
Wnt signaling pathway	384	0	8.79	-	2.35E-02

Table S11. DAVID analysis of enriched biological themes.

Term	Count	P-value	Shared*
GO_BP: 0007608~sensory perception of smell	56	5.01E-27	HDC
GO_BP: 0007606~sensory perception of chemical stimulus	56	4.72E-25	HDC
GO_BP: 0007186~G-protein coupled receptor protein signaling pathway	70	1.46E-16	
GO_BP: 0007600~sensory perception	59	8.15E-16	HDC
GO_BP: 0007166~cell surface receptor linked signal transduction	81	3.73E-11	
GO_BP: 0050877~neurological system process	61	1.90E-10	DC
GO_BP: 0050896~response to stimulus	104	1.07E-08	MDC
GO_BP: 0003008~system process	64	5.01E-08	
GO_BP: 0007165~signal transduction	115	3.16E-07	
GO_BP: 0007154~cell communication	118	1.15E-05	
GO_MF: 0004984~olfactory receptor activity	57	4.94E-29	HMDC
GO_MF: 0004888~transmembrane receptor activity	87	7.63E-24	HMDC
GO_MF: 0004930~G-protein coupled receptor activity	67	8.06E-20	MDC
GO_MF: 0001584~rhodopsin-like receptor activity	61	1.18E-18	HDC
GO_MF: 0004872~receptor activity	99	2.44E-18	HDC
GO_MF: 0004871~signal transducer activity	102	4.95E-14	
GO_MF: 0060089~molecular transducer activity	102	4.95E-14	
GO_CC: 0005886~plasma membrane	129	2.15E-15	
GO_CC: 0016021~integral to membrane	152	8.82E-07	
GO_CC: 0031224~intrinsic to membrane	152	1.20E-06	
GO_CC: 0044425~membrane part	163	7.98E-06	
GO_CC: 0016020~membrane	184	2.91E-05	
GO_CC: 0042612~MHC class I protein complex	10	3.69E-03	
INTERPRO: IPR000725:Olfactory receptor	49	1.01E-21	
INTERPRO: IPR000276:Rhodopsin-like GPCR superfamily	53	4.46E-14	
INTERPRO: IPR006703:AIG1	6	1.91E-04	
INTERPRO: IPR003191:Guanylate-binding protein, C-terminal	6	5.02E-04	
INTERPRO: IPR015894:Guanylate-binding protein, N-terminal	6	2.19E-03	
INTERPRO: IPR001039:MHC class I, alpha chain, alpha1 and alpha2	10	2.96E-03	
KEGG_PATHWAY: hsa04650:Natural killer cell mediated cytotoxicity	12	1.01E-03	
PIR_SUPERFAMILY: PIRSF003152:olfactory receptor OR14	35	2.18E-11	
PIR_SUPERFAMILY: PIRSF038286:preferentially expressed antigen of melanoma (PRAME) family protein	7	2.20E-03	
PIR_SUPERFAMILY: PIRSF037807:retinoic acid early inducible protein 1	5	3.51E-03	
SMART: SM00449:SPRY	10	1.35E-02	
SP_PIR_KEYWORDS: olfaction	49	6.00E-23	
SP_PIR_KEYWORDS: sensory transduction	51	6.24E-18	
SP_PIR_KEYWORDS: g-protein coupled receptor	59	6.04E-17	
SP_PIR_KEYWORDS: transducer	60	1.90E-16	
SP_PIR_KEYWORDS: glycoprotein	129	1.30E-12	
SP_PIR_KEYWORDS: receptor	75	1.93E-10	
SP_PIR_KEYWORDS: membrane	146	1.11E-07	
SP_PIR_KEYWORDS: transmembrane	125	3.82E-06	
UP_SEQ_FEATURE: disulfide bond	101	5.65E-11	
UP_SEQ_FEATURE: topological domain: Extracellular	96	9.22E-11	
UP_SEQ_FEATURE: topological domain: Cytoplasmic	103	2.62E-08	
UP_SEQ_FEATURE: glycosylation site: N-linked (GlcNAc...)	116	3.94E-08	
UP_SEQ_FEATURE: transmembrane region	109	2.02E-04	
UP_SEQ_FEATURE: region of interest: MHC class I alpha-2 like	5	1.69E-02	
UP_SEQ_FEATURE: region of interest: MHC class I alpha-1 like	5	1.69E-02	

* GO terms shared by Human (H), Mouse (M), Dog (D) and Cattle (C) are labeled.

Table S12. High confidence CNV Frequency differences among breeds.

No	CNVR position	Angus	Hereford	Red Angus	Charolais	Gelbvieh	Limousin	Simmental	Genes
10	Chr3:24480004-24654724	0.1818	0.0833	0.6250	0.0909	0.7500	0.7000	0.1250	similar to phosphodiesterase 4D interacting protein (myomegalin) isoform 2
12	Chr3:100032093-100179000	0.1818	0.3333	0.6250	0.1818	0.6250	0.3000	0.5000	SCP2
22	Chr4:117132698-117632250	0.0909	0.0000	0.2500	0.1818	0.0000	0.3000	0.1250	GIMAP GTPase
24	Chr5:9573920-10097114	0.0909	0.0000	0.0000	0.0000	0.2500	0.0000	0.2500	WC1.1, WC1.2
28	Chr5:63165587-63562388	0.5455	0.0000	0.5000	0.0000	0.1250	0.1000	0.1250	similar to olfactory receptor
35	Chr6:63687737-63878973	0.1818	0.1667	0.2500	0.0909	0.2500	0.2000	0.1250	ATP8A1 ATPase
43	Chr7:67686516-67738270	0.1818	0.0000	0.1250	0.0000	0.0000	0.2000	0.0000	no gene
45	Chr7:76922064-77415000	0.0000	0.2500	0.1250	0.0909	0.2500	0.0000	0.1250	similar to melanoma antigen MAGE
56	Chr9:90171000-90490021	0.2727	0.2500	0.2500	0.2727	0.3750	0.5000	0.2500	ULBP
59	Chr10:23295000-24556895	0.4545	0.4167	0.2500	0.4545	0.5000	0.4000	0.2500	similar to T-cell receptor alpha chain
65	Chr11:96563679-96723000	0.1818	0.0833	0.1250	0.1818	0.2500	0.6000	0.2500	similar to olfactory receptor
70	Chr12:69761628-70515700	0.6364	0.2500	0.7500	0.3636	0.6250	0.4000	0.3750	similar to ABCC4
77	Chr14:12877707-13359578	0.1818	0.3333	0.2500	0.3636	0.3750	0.3000	0.7500	similar to mKIAA1477 protein
81	Chr15:6496329-6651000	0.2727	0.2500	0.3750	0.1818	0.1250	0.2000	0.2500	LOC787716 hypothetical protein
90	Chr15:50913000-51021250	0.0909	0.2500	0.0000	0.3636	0.2500	0.2000	0.1250	ART5, TRPC2
91	Chr15:79557444-80205079	0.0909	0.0833	0.0000	0.0000	0.1250	0.0000	0.2500	similar to olfactory receptor
92	Chr15:82809000-83078466	0.1818	0.0000	0.1250	0.2727	0.1250	0.1000	0.3750	GLYAT glycine-N-acyltransferase
100	Chr17:74238123-74413301	0.4545	0.4167	0.2500	0.2727	0.1250	0.5000	0.2500	similar to immunoglobulin V lambda chain, similar to Suppressor of hairy wing homolog
103	Chr18:51135000-51193880	0.2727	0.2500	0.3750	0.2727	0.5000	0.1000	0.1250	similar to carcinoembryonic antigen-related cell adhesion molecule 1 isoform 3L
104	Chr18:57092062-57270472	0.8182	0.0833	0.7500	0.7273	0.6250	0.7000	0.6250	similar to differentiation antigen
108	Chr18:61376379-61498031	0.0000	0.0000	0.0000	0.0909	0.0000	0.2000	0.1250	similar to Solute carrier family 7 (cationic amino acid transporter,C y+ system),C member 3
109	Chr18:61638721-61893000	0.1818	0.1667	0.3750	0.3636	0.3750	0.2000	0.2500	similar to glucose transporter 3, similar to cationic amino acid transporter 5
130	Chr23:26073638-26355693	0.8182	0.5000	0.6250	0.6364	0.3750	0.7000	0.7500	BOLA-DQA and B MHC
134	Chr23:28971000-29026339	0.0909	0.1667	0.0000	0.1818	0.0000	0.0000	0.2500	similar to LOC512938 protein
136	Chr24:6823277-6906090	0.0000	0.0000	0.1250	0.0909	0.2500	0.0000	0.0000	no gene
147	Chr26:43014415-43078689	0.0000	0.0000	0.0000	0.0000	0.1250	0.0000	0.0000	MUCIN similar to deleted in malignant brain tumors 1; similar to bodhesin;
149	Chr27:6543000-7366579	0.0000	0.0000	0.0000	0.0909	0.2500	0.2000	0.5000	DEFB
158	Chr29:2355264-2573057	0.0909	0.1667	0.3750	0.3636	0.2500	0.4000	0.2500	no gene
159	Chr29:5543215-5811455	0.3636	0.0000	0.3750	0.3636	0.5000	0.7000	0.1250	similar to Tripartite motif-containing 43

165	ChrX:24217610-24774856	0.1818	0.1667	0.2500	0.0909	0.1250	0.3000	0.1250	hypothetical protein
167	ChrX:31910755-32083616	0.3636	0.0833	0.2500	0.3636	0.0000	0.2000	0.1250	similar to Chromosome X open reading frame 57
170	ChrX:36963000-37251000	0.0000	0.0000	0.0000	0.2727	0.3750	0.0000	0.2500	hypothetical protein
177	ChrX:83690311-84900000	0.1818	0.0000	0.1250	0.2727	0.0000	0.2000	0.2500	hypothetical protein

Only the breeds with 8 or more samples are presented. We only considered the CNVR frequency when at least two animals show have loss, gain or both events within a breed. Only CNVRs with at lease two breeds show distinct frequencies are included.

Table S13. CNV event counts in the *ULBP* major cluster.

Breeds	Sample	Gain	Loss	Both	Total
ANGUS	11	1	2	0	3
HEREFORD	12	3	0	0	3
RED ANGUS	8	2	0	0	2
CHAROLAIS	11	2	1	0	3
GELBVIEH	8	3	0	0	3
LIMOUSIN	10	5	0	1	6
SIMMENTAL	8	1	1	0	2
Subtotal	73	18	5	1	24
Total*	90	20	8	1	29

* Total includes all 17 breeds.

Table S14. Cattle CNV regions overlap with genomic regions under positive selection, human orthologous OMIM genes and QTLs. See Table S14.xls.

Table S15. V_{ST} calculated for array CGH probes on Btau_4.0.

Chr	Pos	VST	P-value	Rank	FDR	Expected False Positives	Expected True Positives
chr1	3,379,489	0.47	7.41E-05	234	0.1215	28.4	205.6
chr1	5,184,037	0.44	0.000166	415.5	0.1535	63.8	351.7
chr1	10,144,054	0.44	0.000179	436	0.1573	68.6	367.4
chr1	13,932,912	0.42	0.000306	632	0.1858	117.4	514.6
chr1	25,132,873	0.43	0.000201	469	0.1647	77.2	391.8
chr1	32,390,671	0.55	4.94E-06	44	0.0431	1.9	42.1
chr1	44,179,698	0.43	0.000239	541	0.1695	91.7	449.3
chr1	57,939,537	0.45	0.000137	358	0.1465	52.5	305.5
chr1	58,508,966	0.43	0.000231	530	0.1676	88.8	441.2
chr1	63,840,371	0.41	0.000393	767	0.1968	150.9	616.1
chr1	67,981,297	0.43	0.000217	506	0.1644	83.2	422.8
chr1	70,106,041	0.51	1.84E-05	88	0.0804	7.1	80.9
chr1	71,341,130	0.45	0.000121	330	0.1405	46.4	283.6
chr1	75,360,078	0.41	0.000359	705	0.1957	138.0	567.0
chr1	77,491,381	0.53	9.57E-06	66	0.0557	3.7	62.3
chr1	77,638,433	0.41	0.000382	748	0.1961	146.7	601.3
chr1	89,210,014	0.45	0.000138	361	0.1469	53.0	308.0
chr1	90,886,856	0.43	0.000226	519	0.1669	86.6	432.4
chr1	90,918,699	0.41	0.000381	747	0.1958	146.3	600.7
chr1	93,613,133	0.42	0.000262	579	0.1739	100.7	478.3
chr1	94,355,562	0.49	4.21E-05	153	0.1055	16.1	136.9
chr1	103,840,113	0.56	3.71E-06	38	0.0375	1.4	36.6
chr1	105,651,392	0.43	0.000198	464	0.1641	76.1	387.9
chr1	106,348,842	0.42	0.00025	560	0.1712	95.9	464.1
chr1	106,368,179	0.45	0.000134	353	0.1462	51.6	301.4
chr1	124,339,328	0.45	0.000116	319	0.1392	44.4	274.6
chr1	136,800,350	0.41	0.000405	777	0.2000	155.4	621.6
chr1	139,309,024	0.43	0.000191	451	0.1626	73.4	377.6
chr1	145,830,659	0.50	3.07E-05	129	0.0914	11.8	117.2
chr1	151,840,008	0.51	2.05E-05	96	0.0822	7.9	88.1
chr1	158,694,463	0.45	0.000108	301	0.1373	41.3	259.7
chr1	159,635,314	0.50	2.96E-05	125	0.0909	11.4	113.6
chr2	64,496	0.48	5.68E-05	188	0.1160	21.8	166.2
chr2	13,644,922	0.47	7.55E-05	235	0.1234	29.0	206.0
chr2	24,505,948	0.46	8.58E-05	253	0.1302	32.9	220.1
chr2	25,049,749	0.44	0.00016	403	0.1524	61.4	341.6
chr2	31,513,605	0.42	0.000301	626	0.1849	115.8	510.2
chr2	50,144,419	0.45	0.000118	325	0.1396	45.4	279.6

chr2	52,198,770	0.46	0.000103	286	0.1378	39.4	246.6
chr2	68,653,144	0.42	0.000286	601	0.1831	110.0	491.0
chr2	69,440,135	0.43	0.000218	508	0.1652	83.9	424.1
chr2	74,170,039	0.44	0.000153	386	0.1525	58.9	327.1
chr2	76,832,013	0.46	0.000102	283	0.1378	39.0	244.0
chr2	78,272,344	0.46	9.52E-05	272	0.1344	36.6	235.4
chr2	83,040,343	0.42	0.00025	561	0.1712	96.1	464.9
chr2	84,684,849	0.42	0.000297	617	0.1848	114.0	503.0
chr2	85,222,562	0.42	0.000258	572	0.1733	99.1	472.9
chr2	86,950,852	0.43	0.000225	517	0.1674	86.5	430.5
chr2	98,246,655	0.41	0.00037	726	0.1958	142.2	583.8
chr2	101,913,748	0.41	0.000345	686	0.1931	132.4	553.6
chr2	105,363,469	0.44	0.000162	406	0.1534	62.3	343.7
chr2	107,961,931	0.49	4.22E-05	154	0.1053	16.2	137.8
chr2	111,341,230	0.44	0.000148	372.5	0.1527	56.9	315.6
chr2	112,077,065	0.44	0.000157	394	0.1530	60.3	333.7
chr2	115,225,763	0.41	0.000378	737	0.1970	145.2	591.8
chr2	118,790,785	0.42	0.000266	583	0.1751	102.1	480.9
chr2	120,230,403	0.47	7.65E-05	239	0.1228	29.4	209.6
chr2	127,155,335	0.42	0.000282	597	0.1815	108.4	488.6
chr2	132,864,078	0.50	2.33E-05	105	0.0853	9.0	96.0
chr2	134,425,799	0.42	0.000314	652	0.1848	120.5	531.5
chr2	139,334,435	0.56	3.45E-06	36	0.0368	1.3	34.7
chr3	333,051	0.41	0.000383	750	0.1959	147.0	603.0
chr3	1,734,590	0.45	0.000119	326	0.1397	45.5	280.5
chr3	6,195,661	0.45	0.000114	314	0.1398	43.9	270.1
chr3	13,638,806	0.52	1.53E-05	83	0.0710	5.9	77.1
chr3	14,131,522	0.42	0.000297	618	0.1845	114.0	504.0
chr3	14,393,603	0.44	0.000177	433	0.1571	68.0	365.0
chr3	14,585,974	0.42	0.000271	588	0.1770	104.1	483.9
chr3	15,692,803	0.41	0.000356	700	0.1954	136.8	563.2
chr3	19,545,810	0.43	0.000222	514	0.1658	85.2	428.8
chr3	19,648,185	0.43	0.000198	463	0.1642	76.0	387.0
chr3	22,585,742	0.54	7.20E-06	54	0.0512	2.8	51.2
chr3	22,681,964	0.46	8.66E-05	254	0.1309	33.3	220.7
chr3	23,014,586	0.45	0.000109	303	0.1379	41.8	261.2
chr3	24,512,266	0.47	6.83E-05	214	0.1226	26.2	187.8
chr3	24,550,462	0.42	0.000313	650	0.1848	120.1	529.9
chr3	24,634,031	0.49	3.21E-05	132	0.0934	12.3	119.7
chr3	24,646,563	0.49	3.73E-05	147	0.0975	14.3	132.7
chr3	25,568,023	0.46	0.000103	289	0.1369	39.6	249.4
chr3	25,702,507	0.48	5.22E-05	179	0.1120	20.0	159.0

chr3	33,555,648	0.48	4.86E-05	170	0.1097	18.6	151.4
chr3	33,805,235	0.47	7.61E-05	237	0.1233	29.2	207.8
chr3	67,155,444	0.44	0.000158	395	0.1533	60.5	334.5
chr3	79,104,107	0.50	2.44E-05	108	0.0867	9.4	98.6
chr3	87,667,364	0.42	0.000307	638	0.1846	117.8	520.2
chr3	93,184,198	0.48	5.73E-05	190	0.1159	22.0	168.0
chr3	98,118,825	0.41	0.000407	783	0.1995	156.2	626.8
chr3	100,806,654	0.48	5.68E-05	189	0.1154	21.8	167.2
chr3	101,120,331	0.44	0.000182	439	0.1591	69.8	369.2
chr3	102,566,562	0.54	6.22E-06	49	0.0488	2.4	46.6
chr3	114,925,037	0.45	0.000139	362	0.1476	53.4	308.6
chr3	119,232,067	0.59	9.44E-07	15	0.0242	0.4	14.6
chr3	122,803,386	0.45	0.00011	306	0.1384	42.4	263.6
chr3	123,526,728	0.53	8.97E-06	62	0.0556	3.4	58.6
chr3	123,923,527	0.43	0.000205	476	0.1657	78.9	397.1
chr3	125,356,810	0.43	0.000239	540	0.1697	91.6	448.4
chr4	2,694,892	0.43	0.000204	474	0.1651	78.3	395.7
chr4	17,510,473	0.44	0.000162	407	0.1531	62.3	344.7
chr4	23,116,867	0.44	0.000185	442	0.1605	70.9	371.1
chr4	25,465,672	0.44	0.000162	408	0.1527	62.3	345.7
chr4	27,532,952	0.50	2.46E-05	110	0.0860	9.5	100.5
chr4	28,896,397	0.44	0.00018	437	0.1578	69.0	368.0
chr4	28,979,690	0.44	0.000151	381	0.1525	58.1	322.9
chr4	35,053,019	0.48	4.92E-05	174	0.1087	18.9	155.1
chr4	49,216,201	0.47	7.37E-05	232	0.1220	28.3	203.7
chr4	49,452,802	0.42	0.000309	643	0.1844	118.6	524.4
chr4	55,955,481	0.46	9.83E-05	278	0.1358	37.8	240.2
chr4	56,083,322	0.44	0.00016	404	0.1520	61.4	342.6
chr4	59,923,591	0.41	0.000356	699	0.1957	136.8	562.2
chr4	62,445,092	0.51	2.19E-05	101	0.0832	8.4	92.6
chr4	64,589,171	0.42	0.000293	612	0.1841	112.7	499.3
chr4	68,352,498	0.47	5.86E-05	193	0.1167	22.5	170.5
chr4	73,004,833	0.47	6.30E-05	201	0.1204	24.2	176.8
chr4	73,177,703	0.43	0.00023	526	0.1679	88.3	437.7
chr4	73,683,325	0.47	6.95E-05	219	0.1219	26.7	192.3
chr4	73,932,950	0.49	3.38E-05	140	0.0927	13.0	127.0
chr4	74,944,082	0.41	0.000346	688	0.1930	132.8	555.2
chr4	76,051,670	0.57	2.52E-06	28	0.0346	1.0	27.0
chr4	76,672,245	0.41	0.000362	706	0.1967	138.8	567.2
chr4	80,934,596	0.45	0.000136	356	0.1462	52.0	304.0
chr4	81,299,436	0.48	4.74E-05	167	0.1091	18.2	148.8
chr4	81,363,351	0.46	9.59E-05	274	0.1344	36.8	237.2

chr4	85,632,333	0.43	0.000208	485	0.1650	80.0	405.0
chr4	85,836,907	0.63	1.76E-07	6	0.0113	0.1	5.9
chr4	87,212,951	0.46	0.000101	281	0.1377	38.7	242.3
chr4	90,240,263	0.45	0.000126	338	0.1433	48.4	289.6
chr4	94,348,913	0.42	0.000296	615	0.1851	113.8	501.2
chr4	110,604,817	0.41	0.000407	784	0.1995	156.4	627.6
chr4	111,904,282	0.57	2.03E-06	25	0.0312	0.8	24.2
chr4	119,968,455	0.47	5.95E-05	197	0.1160	22.9	174.1
chr4	121,612,878	0.48	5.12E-05	177	0.1110	19.6	157.4
chr5	115,595	0.54	7.56E-06	56	0.0518	2.9	53.1
chr5	1,484,905	0.42	0.000311	647	0.1846	119.4	527.6
chr5	5,619,581	0.41	0.000342	680	0.1932	131.4	548.6
chr5	9,593,924	0.45	0.000114	315	0.1395	44.0	271.0
chr5	9,715,604	0.43	0.000191	453	0.1620	73.4	379.6
chr5	9,824,124	0.49	3.53E-05	143	0.0949	13.6	129.4
chr5	12,755,574	0.52	1.22E-05	75	0.0622	4.7	70.3
chr5	14,195,558	0.45	0.000125	336	0.1427	48.0	288.0
chr5	17,465,693	0.42	0.000318	654	0.1867	122.1	531.9
chr5	26,349,045	0.41	0.000388	758	0.1966	149.0	609.0
chr5	26,668,998	0.46	9.11E-05	264	0.1325	35.0	229.0
chr5	32,832,149	0.42	0.000302	627	0.1852	116.1	510.9
chr5	35,482,051	0.44	0.000172	422	0.1570	66.2	355.8
chr5	36,608,488	0.43	0.000198	462	0.1642	75.9	386.1
chr5	39,840,289	0.43	0.000234	534	0.1680	89.7	444.3
chr5	45,830,716	0.41	0.000368	723	0.1957	141.5	581.5
chr5	55,725,073	0.52	1.15E-05	72	0.0613	4.4	67.6
chr5	62,214,791	0.46	8.80E-05	257	0.1315	33.8	223.2
chr5	62,393,909	0.41	0.000371	727	0.1958	142.3	584.7
chr5	62,841,973	0.49	3.29E-05	134	0.0942	12.6	121.4
chr5	63,212,923	0.47	6.93E-05	218	0.1220	26.6	191.4
chr5	63,430,781	0.51	1.93E-05	90	0.0825	7.4	82.6
chr5	63,705,664	0.45	0.000133	347	0.1471	51.0	296.0
chr5	63,942,560	0.41	0.000345	685	0.1932	132.4	552.6
chr5	64,173,154	0.53	1.13E-05	70	0.0620	4.3	65.7
chr5	65,856,493	0.47	6.97E-05	220	0.1217	26.8	193.2
chr5	66,816,060	0.44	0.000173	423	0.1571	66.4	356.6
chr5	73,260,871	0.43	0.00023	527	0.1676	88.3	438.7
chr5	76,121,913	0.47	6.46E-05	207	0.1198	24.8	182.2
chr5	86,496,100	0.44	0.00016	402	0.1527	61.4	340.6
chr5	93,011,255	0.42	0.000262	578	0.1742	100.7	477.3
chr5	95,097,845	0.41	0.000368	721	0.1961	141.4	579.6
chr5	95,865,895	0.43	0.000231	528	0.1677	88.6	439.4

chr5	99,366,739	0.51	2.12E-05	99	0.0824	8.2	90.8
chr5	103,398,554	0.43	0.000231	529	0.1677	88.7	440.3
chr5	103,552,192	0.45	0.000113	313	0.1391	43.5	269.5
chr5	106,521,649	0.46	9.07E-05	263	0.1325	34.8	228.2
chr5	106,534,860	0.43	0.000199	466	0.1640	76.4	389.6
chr5	109,350,895	0.43	0.000216	504	0.1647	83.0	421.0
chr5	109,862,817	0.43	0.000199	468	0.1633	76.4	391.6
chr5	109,881,811	0.42	0.000264	582	0.1744	101.5	480.5
chr5	109,888,501	0.48	4.54E-05	164	0.1063	17.4	146.6
chr5	109,996,804	0.45	0.000134	352	0.1463	51.5	300.5
chr5	117,216,473	0.46	9.48E-05	271	0.1343	36.4	234.6
chr5	117,907,564	0.41	0.000371	730	0.1953	142.6	587.4
chr5	123,654,792	0.42	0.000259	574	0.1735	99.6	474.4
chr6	9,107,361	0.44	0.000159	398	0.1533	61.0	337.0
chr6	10,419,497	0.42	0.000256	567	0.1736	98.5	468.5
chr6	12,467,321	0.46	9.85E-05	279	0.1355	37.8	241.2
chr6	31,763,594	0.53	8.52E-06	59	0.0555	3.3	55.7
chr6	33,638,539	0.44	0.000152	382	0.1530	58.4	323.6
chr6	36,269,141	0.41	0.000343	682	0.1929	131.6	550.4
chr6	37,600,319	0.46	0.000101	280	0.1380	38.6	241.4
chr6	38,758,621	0.41	0.000362	708	0.1966	139.2	568.8
chr6	41,984,265	0.43	0.000247	553	0.1716	94.9	458.1
chr6	49,228,897	0.41	0.000399	771	0.1987	153.2	617.8
chr6	50,816,186	0.47	7.02E-05	221	0.1219	26.9	194.1
chr6	51,283,365	0.43	0.000207	482	0.1652	79.6	402.4
chr6	63,052,954	0.53	9.32E-06	63	0.0568	3.6	59.4
chr6	64,428,938	0.50	2.89E-05	121	0.0918	11.1	109.9
chr6	67,866,074	0.43	0.000208	484	0.1651	79.9	404.1
chr6	69,600,395	0.44	0.000155	389	0.1532	59.6	329.4
chr6	69,728,278	0.46	0.000105	294	0.1369	40.3	253.7
chr6	70,272,020	0.53	8.48E-06	58	0.0562	3.3	54.7
chr6	71,219,249	0.47	6.41E-05	205	0.1201	24.6	180.4
chr6	72,691,432	0.81	1.83E-12	1	0.0000	0.0	1.0
chr6	73,619,342	0.57	2.55E-06	29	0.0338	1.0	28.0
chr6	77,926,476	0.44	0.000159	399	0.1530	61.1	337.9
chr6	81,696,494	0.46	8.55E-05	252	0.1302	32.8	219.2
chr6	81,952,377	0.42	0.000301	625	0.1851	115.7	509.3
chr6	82,291,355	0.43	0.000193	455	0.1628	74.1	380.9
chr6	82,912,179	0.43	0.000203	473	0.1650	78.0	395.0
chr6	85,881,939	0.44	0.000176	430	0.1569	67.5	362.5
chr6	93,869,145	0.43	0.000213	498	0.1639	81.6	416.4
chr6	94,508,892	0.41	0.000328	661	0.1906	126.0	535.0

chr6	95,097,854	0.41	0.000331	666	0.1907	127.0	539.0
chr6	108,966,720	0.45	0.000123	332.5	0.1419	47.2	285.3
chr6	109,792,322	0.42	0.000264	581	0.1747	101.5	479.5
chr6	115,558,424	0.41	0.000383	751	0.1958	147.1	603.9
chr7	5,548,884	0.41	0.000397	770	0.1980	152.5	617.5
chr7	6,649,766	0.41	0.000365	715	0.1961	140.2	574.8
chr7	12,742,679	0.53	8.94E-06	60	0.0572	3.4	56.6
chr7	13,581,203	0.41	0.000357	701	0.1956	137.1	563.9
chr7	14,048,109	0.56	2.75E-06	30	0.0352	1.1	28.9
chr7	14,188,833	0.46	9.20E-05	267	0.1323	35.3	231.7
chr7	14,886,899	0.45	0.000119	328	0.1397	45.8	282.2
chr7	18,714,017	0.42	0.000273	589	0.1782	105.0	484.0
chr7	21,068,804	0.42	0.000258	571	0.1736	99.1	471.9
chr7	23,488,086	0.41	0.00033	664	0.1908	126.7	537.3
chr7	25,709,091	0.44	0.000145	366	0.1521	55.7	310.3
chr7	25,728,233	0.42	0.000308	642	0.1845	118.4	523.6
chr7	39,341,287	0.46	8.73E-05	256	0.1309	33.5	222.5
chr7	45,516,980	0.43	0.000202	471	0.1646	77.5	393.5
chr7	46,489,696	0.50	2.40E-05	106	0.0870	9.2	96.8
chr7	50,598,573	0.48	5.84E-05	192	0.1167	22.4	169.6
chr7	51,795,594	0.43	0.000212	497	0.1641	81.6	415.4
chr7	58,304,309	0.41	0.000364	711	0.1963	139.6	571.4
chr7	62,650,048	0.44	0.000153	383	0.1530	58.6	324.4
chr7	64,448,281	0.51	2.17E-05	100	0.0833	8.3	91.7
chr7	67,379,252	0.41	0.000367	718	0.1965	141.1	576.9
chr7	68,064,126	0.42	0.000256	566	0.1739	98.4	467.6
chr7	72,025,762	0.41	0.000366	717	0.1961	140.6	576.4
chr7	79,846,717	0.42	0.000293	611	0.1844	112.6	498.4
chr7	89,772,981	0.42	0.000297	616	0.1850	114.0	502.0
chr7	93,523,529	0.42	0.000317	653	0.1864	121.7	531.3
chr7	105,805,032	0.53	1.11E-05	67	0.0637	4.3	62.7
chr7	110,022,792	0.46	9.63E-05	275	0.1345	37.0	238.0
chr7	110,323,529	0.42	0.000284	600	0.1819	109.1	490.9
chr8	819,433	0.41	0.000344	684	0.1931	132.1	551.9
chr8	1,484,943	0.41	0.000378	738	0.1967	145.2	592.8
chr8	6,489,613	0.42	0.000304	629	0.1858	116.9	512.1
chr8	18,886,753	0.45	0.000137	360	0.1466	52.8	307.2
chr8	23,245,191	0.57	2.08E-06	27	0.0296	0.8	26.2
chr8	23,840,491	0.46	0.000101	282	0.1381	39.0	243.0
chr8	29,715,448	0.50	2.94E-05	123	0.0918	11.3	111.7
chr8	31,219,427	0.48	4.70E-05	166	0.1088	18.1	147.9
chr8	31,782,564	0.45	0.000109	302	0.1380	41.7	260.3

chr8	38,624,361	0.43	0.000242	545	0.1705	92.9	452.1
chr8	39,424,501	0.45	0.000115	318	0.1394	44.3	273.7
chr8	44,467,269	0.44	0.000175	428	0.1570	67.2	360.8
chr8	50,579,662	0.44	0.000174	427	0.1568	67.0	360.0
chr8	51,654,467	0.44	0.000148	372.5	0.1527	56.9	315.6
chr8	52,633,756	0.48	4.65E-05	165	0.1083	17.9	147.1
chr8	55,411,560	0.42	0.000298	619	0.1847	114.3	504.7
chr8	56,102,852	0.47	6.61E-05	209	0.1214	25.4	183.6
chr8	56,109,203	0.42	0.000291	607	0.1841	111.8	495.2
chr8	62,496,498	0.43	0.000209	487	0.1649	80.3	406.7
chr8	69,030,488	0.42	0.000306	633	0.1858	117.6	515.4
chr8	69,696,323	0.42	0.000313	651	0.1848	120.3	530.7
chr8	72,979,210	0.46	9.77E-05	277	0.1355	37.5	239.5
chr8	74,265,952	0.42	0.000256	565	0.1740	98.3	466.7
chr8	80,627,331	0.41	0.000353	695	0.1950	135.5	559.5
chr8	84,986,056	0.49	4.27E-05	156	0.1051	16.4	139.6
chr8	85,485,131	0.44	0.000159	400	0.1527	61.1	338.9
chr8	91,008,157	0.45	0.000124	334	0.1427	47.7	286.3
chr8	95,059,222	0.42	0.000298	621	0.1845	114.6	506.4
chr8	95,814,757	0.43	0.00022	509	0.1659	84.5	424.5
chr8	97,811,246	0.41	0.000369	724	0.1956	141.6	582.4
chr8	103,264,241	0.42	0.000325	657	0.1900	124.8	532.2
chr8	104,525,262	0.43	0.000222	513	0.1658	85.1	427.9
chr8	105,516,989	0.45	0.000119	327	0.1400	45.8	281.2
chr8	107,699,338	0.50	2.95E-05	124	0.0913	11.3	112.7
chr8	109,440,328	0.45	0.00013	342	0.1457	49.8	292.2
chr8	111,942,636	0.44	0.000172	421	0.1572	66.2	354.8
chr8	114,080,314	0.41	0.000328	663	0.1902	126.1	536.9
chr9	2,477,264	0.46	0.000105	295	0.1370	40.4	254.6
chr9	3,270,478	0.41	0.000358	702	0.1960	137.6	564.4
chr9	4,749,277	0.51	1.64E-05	85	0.0741	6.3	78.7
chr9	13,222,816	0.57	2.07E-06	26	0.0306	0.8	25.2
chr9	15,315,257	0.60	6.58E-07	11	0.0230	0.3	10.7
chr9	17,267,368	0.41	0.000391	760	0.1974	150.0	610.0
chr9	17,504,344	0.46	9.13E-05	265	0.1323	35.1	229.9
chr9	19,302,886	0.43	0.000224	516	0.1664	85.9	430.1
chr9	22,234,081	0.43	0.000202	470	0.1648	77.5	392.5
chr9	23,174,741	0.41	0.000407	782	0.1997	156.1	625.9
chr9	25,248,280	0.41	0.000387	757	0.1964	148.7	608.3
chr9	27,942,528	0.41	0.000393	764	0.1974	150.8	613.2
chr9	32,493,022	0.41	0.000375	733	0.1967	144.2	588.8
chr9	41,984,351	0.57	2.02E-06	23	0.0337	0.8	22.2

chr9	55,974,679	0.42	0.000289	603	0.1838	110.8	492.2
chr9	64,294,893	0.43	0.000243	547	0.1708	93.4	453.6
chr9	66,970,052	0.50	2.91E-05	122	0.0915	11.2	110.8
chr9	73,081,610	0.42	0.000321	656	0.1878	123.2	532.8
chr9	74,707,644	0.52	1.48E-05	81	0.0700	5.7	75.3
chr9	75,123,210	0.44	0.000145	367	0.1518	55.7	311.3
chr9	85,997,298	0.42	0.000279	593	0.1804	107.0	486.0
chr9	88,563,202	0.42	0.000268	586	0.1757	103.0	483.0
chr9	88,582,769	0.47	7.66E-05	240	0.1226	29.4	210.6
chr9	88,870,760	0.46	9.75E-05	276	0.1356	37.4	238.6
chr9	98,272,222	0.43	0.000245	550	0.1713	94.2	455.8
chr9	101,338,001	0.41	0.000386	754	0.1967	148.3	605.7
chr10	435,687	0.42	0.000301	623	0.1853	115.4	507.6
chr10	3,053,029	0.47	7.24E-05	226	0.1231	27.8	198.2
chr10	4,288,493	0.41	0.00035	693	0.1938	134.3	558.7
chr10	5,760,474	0.53	1.14E-05	71	0.0615	4.4	66.6
chr10	13,581,269	0.46	0.000102	284	0.1374	39.0	245.0
chr10	20,307,628	0.60	5.43E-07	10	0.0208	0.2	9.8
chr10	26,265,617	0.54	6.36E-06	51	0.0479	2.4	48.6
chr10	30,380,889	0.44	0.000156	392	0.1531	60.0	332.0
chr10	31,123,675	0.43	0.000229	524	0.1675	87.8	436.2
chr10	36,275,377	0.44	0.000155	388	0.1530	59.4	328.6
chr10	51,334,486	0.44	0.000153	385	0.1527	58.8	326.2
chr10	51,603,488	0.45	0.000134	354	0.1459	51.6	302.4
chr10	54,560,030	0.43	0.000249	557	0.1716	95.6	461.4
chr10	62,086,739	0.46	9.56E-05	273	0.1344	36.7	236.3
chr10	62,483,460	0.47	7.32E-05	230	0.1222	28.1	201.9
chr10	63,238,719	0.43	0.000236	537	0.1686	90.5	446.5
chr10	67,302,628	0.44	0.000144	365	0.1515	55.3	309.7
chr10	70,252,813	0.46	0.000103	287	0.1374	39.4	247.6
chr10	73,939,430	0.41	0.000371	729	0.1954	142.5	586.5
chr10	75,328,499	0.48	5.83E-05	191	0.1172	22.4	168.6
chr10	77,645,206	0.41	0.000364	714	0.1959	139.9	574.1
chr10	83,577,601	0.41	0.000347	689	0.1936	133.4	555.6
chr10	84,486,670	0.59	9.52E-07	16	0.0229	0.4	15.6
chr10	88,192,144	0.43	0.000221	511	0.1663	85.0	426.0
chr10	93,088,245	0.47	6.03E-05	198	0.1170	23.2	174.8
chr10	97,177,666	0.50	3.07E-05	128	0.0920	11.8	116.2
chr10	103,162,023	0.46	7.96E-05	247	0.1238	30.6	216.4
chr11	1,152,383	0.44	0.000173	425	0.1564	66.5	358.5
chr11	7,603,305	0.41	0.000381	746	0.1960	146.2	599.8
chr11	11,168,304	0.47	7.62E-05	238	0.1229	29.3	208.7

chr11	11,321,640	0.50	2.84E-05	119	0.0918	10.9	108.1
chr11	12,025,609	0.47	5.88E-05	194	0.1164	22.6	171.4
chr11	20,998,708	0.44	0.000166	415.5	0.1535	63.8	351.7
chr11	21,568,281	0.54	7.31E-06	55	0.0511	2.8	52.2
chr11	28,012,990	0.43	0.00021	492	0.1642	80.8	411.2
chr11	29,107,542	0.52	1.22E-05	76	0.0617	4.7	71.3
chr11	32,416,045	0.49	3.37E-05	138	0.0939	13.0	125.0
chr11	34,361,974	0.44	0.000173	424	0.1568	66.5	357.5
chr11	38,355,589	0.43	0.000228	521	0.1678	87.4	433.6
chr11	51,507,391	0.47	6.34E-05	203	0.1199	24.3	178.7
chr11	52,115,264	0.53	9.54E-06	65	0.0564	3.7	61.3
chr11	67,411,612	0.43	0.000216	505	0.1646	83.1	421.9
chr11	71,065,743	0.45	0.00012	329	0.1397	46.0	283.0
chr11	71,801,896	0.45	0.000113	312	0.1389	43.3	268.7
chr11	75,462,548	0.49	3.91E-05	151	0.0994	15.0	136.0
chr11	76,096,363	0.55	4.93E-06	43	0.0440	1.9	41.1
chr11	76,345,740	0.41	0.00038	742	0.1965	145.8	596.2
chr11	80,582,803	0.45	0.000111	309	0.1385	42.8	266.2
chr11	83,296,176	0.46	0.000105	292	0.1375	40.1	251.9
chr11	88,000,310	0.43	0.000211	493	0.1643	81.0	412.0
chr11	89,344,085	0.44	0.000161	405	0.1525	61.8	343.2
chr11	89,696,041	0.41	0.000338	678	0.1912	129.7	548.3
chr11	99,571,201	0.41	0.000392	763	0.1974	150.6	612.4
chr12	294,476	0.44	0.00017	418	0.1563	65.3	352.7
chr12	2,182,441	0.43	0.000206	477	0.1658	79.1	397.9
chr12	6,131,657	0.41	0.000335	673	0.1910	128.5	544.5
chr12	6,374,664	0.43	0.000191	452	0.1624	73.4	378.6
chr12	6,534,758	0.46	8.85E-05	258	0.1317	34.0	224.0
chr12	6,937,636	0.42	0.000307	637	0.1849	117.8	519.2
chr12	7,987,563	0.51	1.69E-05	87	0.0744	6.5	80.5
chr12	9,222,408	0.42	0.000284	599	0.1818	108.9	490.1
chr12	9,261,222	0.43	0.000242	546	0.1704	93.0	453.0
chr12	17,773,041	0.41	0.000405	779.5	0.1996	155.6	623.9
chr12	18,720,410	0.42	0.000325	658	0.1897	124.8	533.2
chr12	20,742,798	0.44	0.000156	390	0.1533	59.8	330.2
chr12	33,996,846	0.42	0.000309	644	0.1843	118.7	525.3
chr12	52,268,976	0.49	4.28E-05	157	0.1047	16.4	140.6
chr12	55,456,066	0.41	0.000377	736	0.1969	144.9	591.1
chr12	69,881,765	0.48	4.80E-05	169	0.1091	18.4	150.6
chr12	72,627,503	0.41	0.000401	772	0.1997	154.1	617.9
chr12	75,616,007	0.54	5.99E-06	46	0.0500	2.3	43.7
chr12	75,840,486	0.62	2.49E-07	7	0.0137	0.1	6.9

chr12	77,088,108	0.46	9.43E-05	270	0.1341	36.2	233.8
chr12	78,041,826	0.42	0.000306	635	0.1853	117.7	517.3
chr13	1,164,908	0.52	1.17E-05	73	0.0613	4.5	68.5
chr13	2,349,142	0.50	2.41E-05	107	0.0866	9.3	97.7
chr13	3,366,440	0.42	0.000259	573	0.1736	99.5	473.5
chr13	16,108,827	0.44	0.000171	419	0.1564	65.5	353.5
chr13	23,737,605	0.48	4.92E-05	173	0.1092	18.9	154.1
chr13	24,896,245	0.41	0.000393	766	0.1969	150.8	615.2
chr13	27,020,875	0.43	0.000237	538	0.1689	90.8	447.2
chr13	27,654,777	0.42	0.000278	592	0.1805	106.8	485.2
chr13	28,416,206	0.50	2.51E-05	112	0.0859	9.6	102.4
chr13	32,621,186	0.57	2.03E-06	24	0.0324	0.8	23.2
chr13	35,533,262	0.41	0.000362	707	0.1967	139.0	568.0
chr13	37,184,412	0.41	0.000412	791	0.2000	158.2	632.8
chr13	40,275,266	0.47	6.33E-05	202	0.1203	24.3	177.7
chr13	44,505,901	0.51	1.95E-05	91	0.0823	7.5	83.5
chr13	58,381,249	0.41	0.000364	712	0.1962	139.7	572.3
chr13	60,780,919	0.45	0.000139	363	0.1473	53.5	309.5
chr13	62,566,776	0.51	1.97E-05	93	0.0814	7.6	85.4
chr13	62,841,627	0.44	0.000165	412.5	0.1540	63.5	349.0
chr13	71,770,094	0.43	0.000218	507	0.1649	83.6	423.4
chr13	79,930,077	0.53	9.39E-06	64	0.0563	3.6	60.4
chr13	82,297,999	0.43	0.000249	558	0.1713	95.6	462.4
chr13	83,008,500	0.44	0.000184	441	0.1598	70.5	370.5
chr14	3,123,420	0.41	0.00038	744	0.1963	146.0	598.0
chr14	4,115,674	0.43	0.00021	489	0.1650	80.7	408.3
chr14	4,345,869	0.45	0.000116	320	0.1397	44.7	275.3
chr14	5,062,866	0.41	0.000352	694	0.1950	135.3	558.7
chr14	6,137,753	0.46	9.01E-05	262	0.1320	34.6	227.4
chr14	9,248,063	0.42	0.000312	649	0.1845	119.7	529.3
chr14	10,451,654	0.44	0.000158	396	0.1530	60.6	335.4
chr14	10,694,702	0.43	0.000207	480.5	0.1655	79.5	401.0
chr14	11,795,690	0.45	0.000128	339	0.1446	49.0	290.0
chr14	12,972,956	0.44	0.000187	443	0.1624	71.9	371.1
chr14	12,992,189	0.47	6.26E-05	200	0.1203	24.1	175.9
chr14	13,094,586	0.43	0.000221	510	0.1662	84.8	425.2
chr14	13,120,151	0.60	7.47E-07	14	0.0205	0.3	13.7
chr14	15,405,272	0.41	0.000334	670	0.1916	128.4	541.6
chr14	21,728,052	0.43	0.00019	449	0.1626	73.0	376.0
chr14	22,643,245	0.54	6.34E-06	50	0.0487	2.4	47.6
chr14	22,950,665	0.68	1.46E-08	4	0.0014	0.0	4.0
chr14	24,320,170	0.45	0.000117	322	0.1398	45.0	277.0

chr14	24,377,717	0.42	0.00028	595	0.1805	107.4	487.6
chr14	26,220,807	0.46	8.93E-05	261	0.1314	34.3	226.7
chr14	26,387,684	0.44	0.000173	426	0.1561	66.5	359.5
chr14	28,473,603	0.42	0.000254	563.5	0.1728	97.4	466.1
chr14	29,043,250	0.43	0.000199	465	0.1643	76.4	388.6
chr14	29,299,372	0.44	0.000171	420	0.1568	65.8	354.2
chr14	29,357,016	0.43	0.000194	457	0.1631	74.5	382.5
chr14	41,606,687	0.55	4.47E-06	39	0.0440	1.7	37.3
chr14	42,041,766	0.44	0.000188	446	0.1616	72.1	373.9
chr14	42,297,632	0.52	1.57E-05	84	0.0717	6.0	78.0
chr14	42,758,658	0.42	0.000269	587	0.1760	103.3	483.7
chr14	52,896,061	0.45	0.000107	299	0.1373	41.1	257.9
chr14	58,528,330	0.41	0.000369	725	0.1954	141.7	583.3
chr14	61,030,616	0.43	0.000214	500	0.1642	82.1	417.9
chr14	61,843,657	0.47	7.15E-05	223	0.1232	27.5	195.5
chr14	68,077,077	0.46	8.31E-05	249	0.1282	31.9	217.1
chr14	69,664,088	0.50	2.46E-05	109	0.0865	9.4	99.6
chr14	70,745,677	0.41	0.000337	677	0.1912	129.4	547.6
chr14	72,377,890	0.47	7.72E-05	243	0.1220	29.7	213.3
chr15	2,425,940	0.55	4.48E-06	41	0.0419	1.7	39.3
chr15	4,198,482	0.47	7.73E-05	244	0.1217	29.7	214.3
chr15	7,360,078	0.41	0.000393	768	0.1966	151.0	617.0
chr15	10,112,497	0.46	0.000105	293	0.1374	40.3	252.7
chr15	17,011,244	0.45	0.000132	346	0.1467	50.7	295.3
chr15	18,317,101	0.47	6.79E-05	211	0.1237	26.1	184.9
chr15	23,449,961	0.46	8.18E-05	248	0.1266	31.4	216.6
chr15	24,569,953	0.43	0.000248	554	0.1718	95.2	458.8
chr15	25,990,859	0.44	0.000177	431	0.1573	67.8	363.2
chr15	26,041,755	0.50	2.27E-05	103	0.0847	8.7	94.3
chr15	35,014,644	0.45	0.000111	308	0.1383	42.6	265.4
chr15	40,185,601	0.41	0.000328	662	0.1904	126.0	536.0
chr15	42,988,968	0.41	0.000354	696	0.1953	135.9	560.1
chr15	43,545,813	0.45	0.000125	337	0.1429	48.2	288.8
chr15	50,451,282	0.48	5.04E-05	175	0.1105	19.3	155.7
chr15	53,453,069	0.49	3.38E-05	139	0.0933	13.0	126.0
chr15	69,978,067	0.49	3.18E-05	130	0.0938	12.2	117.8
chr15	70,707,291	0.48	5.39E-05	183	0.1130	20.7	162.3
chr15	72,435,459	0.43	0.000228	522	0.1677	87.6	434.4
chr15	74,016,441	0.43	0.000227	520	0.1675	87.1	432.9
chr15	79,193,753	0.41	0.000335	675	0.1905	128.6	546.4
chr15	83,923,343	0.45	0.000131	344	0.1460	50.2	293.8
chr15	84,429,299	0.49	3.69E-05	146	0.0969	14.2	131.8

chr16	4,057,967	0.49	3.31E-05	136	0.0934	12.7	123.3
chr16	4,083,422	0.60	7.14E-07	13	0.0211	0.3	12.7
chr16	4,089,923	0.44	0.000178	434	0.1574	68.3	365.7
chr16	7,059,701	0.42	0.000307	639	0.1846	118.0	521.0
chr16	10,790,683	0.42	0.000307	636	0.1852	117.8	518.2
chr16	23,872,155	0.42	0.000278	591	0.1806	106.7	484.3
chr16	36,595,675	0.43	0.000232	531	0.1676	89.0	442.0
chr16	38,572,864	0.50	2.66E-05	116	0.0882	10.2	105.8
chr16	41,369,989	0.41	0.000384	752	0.1962	147.5	604.5
chr16	41,491,595	0.51	1.89E-05	89	0.0817	7.3	81.7
chr16	42,451,276	0.58	1.73E-06	20	0.0332	0.7	19.3
chr16	43,532,801	0.44	0.000188	445	0.1619	72.1	372.9
chr16	43,552,336	0.42	0.000306	634	0.1856	117.7	516.3
chr16	44,697,988	0.48	4.30E-05	158	0.1046	16.5	141.5
chr16	61,600,421	0.49	3.18E-05	131	0.0933	12.2	118.8
chr16	65,350,651	0.41	0.000387	755	0.1967	148.5	606.5
chr16	67,750,645	0.41	0.000332	667	0.1914	127.7	539.3
chr16	71,571,492	0.42	0.000283	598	0.1816	108.6	489.4
chr16	76,102,420	0.41	0.00038	743	0.1964	145.9	597.1
chr17	6,227,575	0.41	0.000349	692	0.1937	134.0	558.0
chr17	6,502,783	0.50	3.00E-05	126	0.0914	11.5	114.5
chr17	20,736,032	0.55	4.47E-06	40	0.0430	1.7	38.3
chr17	23,769,788	0.41	0.000348	690	0.1934	133.5	556.5
chr17	34,297,672	0.44	0.000163	409	0.1528	62.5	346.5
chr17	34,323,598	0.47	7.30E-05	229	0.1225	28.1	200.9
chr17	35,180,808	0.44	0.000151	378	0.1531	57.9	320.1
chr17	36,134,827	0.45	0.000107	298	0.1375	41.0	257.0
chr17	42,086,756	0.50	2.31E-05	104	0.0853	8.9	95.1
chr17	44,051,627	0.44	0.000167	417	0.1541	64.2	352.8
chr17	63,091,506	0.44	0.000154	387	0.1532	59.3	327.7
chr17	74,061,071	0.45	0.000107	300	0.1373	41.2	258.8
chr18	5,920,092	0.41	0.000356	698	0.1956	136.6	561.4
chr18	10,778,010	0.50	2.77E-05	118	0.0901	10.6	107.4
chr18	17,107,589	0.41	0.000363	710	0.1964	139.5	570.5
chr18	30,432,180	0.44	0.000176	429	0.1571	67.4	361.6
chr18	55,520,007	0.42	0.00031	645	0.1843	118.9	526.1
chr18	56,973,224	0.45	0.000111	307	0.1387	42.6	264.4
chr18	57,030,500	0.41	0.00039	759	0.1976	150.0	609.0
chr18	63,763,393	0.42	0.000294	613	0.1841	112.9	500.1
chr18	63,904,003	0.42	0.000258	570	0.1737	99.0	471.0
chr19	17,772,894	0.41	0.000371	728	0.1957	142.4	585.6
chr19	23,296,188	0.41	0.000344	683	0.1932	132.0	551.0

chr19	26,131,413	0.41	0.000335	672	0.1912	128.5	543.5
chr19	29,811,327	0.41	0.000364	713	0.1960	139.8	573.2
chr19	36,921,847	0.44	0.00015	377	0.1532	57.8	319.2
chr19	38,797,157	0.41	0.000381	745	0.1961	146.1	598.9
chr19	46,214,748	0.52	1.35E-05	78	0.0662	5.2	72.8
chr19	48,896,304	0.43	0.000212	496	0.1643	81.5	414.5
chr19	48,915,234	0.50	2.49E-05	111	0.0862	9.6	101.4
chr19	59,027,291	0.47	7.02E-05	222	0.1214	26.9	195.1
chr19	59,929,752	0.41	0.00033	665	0.1906	126.7	538.3
chr19	60,147,479	0.41	0.000395	769	0.1972	151.7	617.3
chr19	62,796,835	0.47	6.06E-05	199	0.1170	23.3	175.7
chr20	3,616,072	0.41	0.000359	703	0.1960	137.8	565.2
chr20	4,979,444	0.43	0.000197	460	0.1643	75.6	384.4
chr20	6,796,823	0.52	1.52E-05	82	0.0710	5.8	76.2
chr20	10,189,147	0.42	0.000268	585	0.1759	102.9	482.1
chr20	11,680,418	0.47	6.63E-05	210	0.1212	25.5	184.5
chr20	20,627,421	0.43	0.000228	523	0.1674	87.6	435.4
chr20	21,344,096	0.43	0.000225	518	0.1670	86.5	431.5
chr20	22,611,318	0.44	0.000148	370	0.1532	56.7	313.3
chr20	24,480,194	0.42	0.000279	594	0.1804	107.2	486.8
chr20	40,236,877	0.48	5.32E-05	181	0.1129	20.4	160.6
chr20	46,457,657	0.51	2.03E-05	95	0.0822	7.8	87.2
chr20	48,448,345	0.55	4.53E-06	42	0.0414	1.7	40.3
chr20	49,229,249	0.43	0.000196	459	0.1642	75.4	383.6
chr20	49,491,569	0.42	0.000301	624	0.1852	115.6	508.4
chr20	50,688,023	0.46	0.000104	291	0.1376	40.1	250.9
chr20	61,197,298	0.42	0.000256	568	0.1734	98.5	469.5
chr20	61,600,245	0.41	0.000345	687	0.1929	132.5	554.5
chr20	62,336,234	0.41	0.000393	765	0.1971	150.8	614.2
chr20	67,354,097	0.46	0.000106	296	0.1374	40.7	255.3
chr20	67,526,436	0.42	0.000254	563.5	0.1728	97.4	466.1
chr20	68,089,928	0.56	2.96E-06	32	0.0355	1.1	30.9
chr20	68,294,763	0.45	0.000117	323	0.1397	45.1	277.9
chr20	72,588,933	0.43	0.00021	488	0.1652	80.6	407.4
chr20	74,784,181	0.42	0.000307	640	0.1844	118.0	522.0
chr21	1,798,752	0.46	0.000103	290	0.1370	39.7	250.3
chr21	3,238,588	0.52	1.24E-05	77	0.0617	4.8	72.2
chr21	4,538,060	0.42	0.00025	562	0.1711	96.2	465.8
chr21	7,417,809	0.44	0.000151	379	0.1532	58.0	321.0
chr21	10,272,497	0.45	0.000133	349	0.1464	51.1	297.9
chr21	10,860,917	0.45	0.000137	359	0.1466	52.6	306.4
chr21	15,244,801	0.64	1.26E-07	5	0.0097	0.0	5.0

chr21	24,755,223	0.45	0.000115	316	0.1395	44.1	271.9
chr21	30,476,919	0.48	5.56E-05	186	0.1147	21.3	164.7
chr21	31,577,819	0.41	0.000368	722	0.1958	141.4	580.6
chr21	34,150,711	0.41	0.000334	668	0.1917	128.1	539.9
chr21	43,245,041	0.41	0.000391	762	0.1971	150.2	611.8
chr21	50,291,341	0.47	6.41E-05	206	0.1195	24.6	181.4
chr21	52,633,609	0.43	0.000209	486	0.1648	80.1	405.9
chr21	60,614,480	0.52	1.44E-05	79	0.0702	5.5	73.5
chr22	1,612,827	0.43	0.000233	532	0.1680	89.4	442.6
chr22	2,694,784	0.48	4.36E-05	159	0.1053	16.7	142.3
chr22	13,216,259	0.53	8.95E-06	61	0.0563	3.4	57.6
chr22	28,614,691	0.43	0.00021	490	0.1647	80.7	409.3
chr22	28,640,087	0.46	0.000106	297	0.1371	40.7	256.3
chr22	29,107,436	0.43	0.000239	542	0.1693	91.8	450.2
chr22	31,104,494	0.43	0.000245	549	0.1713	94.0	455.0
chr22	31,353,629	0.57	1.98E-06	22	0.0345	0.8	21.2
chr22	33,798,858	0.44	0.000151	380	0.1529	58.1	321.9
chr22	38,355,311	0.51	1.65E-05	86	0.0737	6.3	79.7
chr22	39,373,003	0.48	5.47E-05	184	0.1141	21.0	163.0
chr22	42,041,652	0.41	0.000368	719	0.1965	141.3	577.7
chr22	44,883,544	0.47	6.82E-05	213	0.1230	26.2	186.8
chr22	47,859,271	0.44	0.00018	438	0.1577	69.1	368.9
chr22	50,067,407	0.41	0.000375	732	0.1969	144.2	587.8
chr22	53,158,789	0.45	0.000136	357	0.1463	52.2	304.8
chr22	55,468,891	0.49	3.42E-05	141	0.0931	13.1	127.9
chr22	59,776,083	0.45	0.000128	341	0.1447	49.3	291.7
chr22	61,280,038	0.45	0.000112	310	0.1382	42.8	267.2
chr23	1,497,725	0.48	4.43E-05	162	0.1050	17.0	145.0
chr23	3,053,290	0.44	0.000156	393	0.1529	60.1	332.9
chr23	3,149,139	0.41	0.000391	761	0.1973	150.1	610.9
chr23	8,857,707	0.41	0.000334	671	0.1914	128.4	542.6
chr23	13,203,327	0.43	0.000248	555	0.1715	95.2	459.8
chr23	15,731,696	0.43	0.000235	536	0.1686	90.4	445.6
chr23	16,000,476	0.41	0.000376	734	0.1968	144.4	589.6
chr23	16,870,893	0.41	0.000365	716	0.1959	140.3	575.7
chr23	19,046,900	0.47	7.40E-05	233	0.1219	28.4	204.6
chr23	20,729,976	0.43	0.000242	544	0.1705	92.8	451.2
chr23	26,938,054	0.62	3.07E-07	8	0.0147	0.1	7.9
chr23	26,963,411	0.42	0.000296	614	0.1850	113.6	500.4
chr23	34,259,439	0.42	0.000277	590	0.1803	106.4	483.6
chr23	39,955,283	0.47	7.34E-05	231	0.1220	28.2	202.8
chr23	49,363,286	0.41	0.000359	704	0.1958	137.9	566.1

chr23	50,476,809	0.43	0.000223	515	0.1663	85.6	429.4
chr24	6,969,707	0.45	0.000133	348	0.1468	51.1	296.9
chr24	11,648,494	0.47	6.84E-05	215	0.1221	26.3	188.7
chr24	11,852,857	0.48	5.15E-05	178	0.1111	19.8	158.2
chr24	13,158,853	0.43	0.000198	461	0.1645	75.8	385.2
chr24	18,809,863	0.49	3.31E-05	137	0.0929	12.7	124.3
chr24	20,940,998	0.41	0.000405	779.5	0.1996	155.6	623.9
chr24	27,917,189	0.68	1.36E-08	3	0.0017	0.0	3.0
chr24	31,872,292	0.43	0.000199	467	0.1637	76.4	390.6
chr24	34,188,804	0.46	8.89E-05	259	0.1318	34.1	224.9
chr24	39,834,023	0.42	0.000298	620	0.1847	114.5	505.5
chr24	43,117,007	0.58	1.22E-06	17	0.0275	0.5	16.5
chr24	43,558,873	0.46	9.25E-05	268	0.1325	35.5	232.5
chr24	46,413,280	0.48	4.39E-05	160	0.1053	16.9	143.1
chr24	53,606,540	0.43	0.000234	533	0.1683	89.7	443.3
chr24	54,355,648	0.42	0.000287	602	0.1833	110.3	491.7
chr24	55,238,513	0.43	0.000205	475	0.1655	78.6	396.4
chr24	59,424,351	0.47	6.41E-05	204	0.1206	24.6	179.4
chr24	59,968,083	0.46	9.33E-05	269	0.1332	35.8	233.2
chr24	60,928,132	0.45	0.000133	350	0.1464	51.2	298.8
chr24	60,941,262	0.42	0.000304	628	0.1859	116.7	511.3
chr24	62,291,260	0.44	0.000145	368	0.1516	55.8	312.2
chr25	3,584,409	0.45	0.000123	332.5	0.1419	47.2	285.3
chr25	5,830,475	0.41	0.000336	676	0.1911	129.2	546.8
chr25	7,520,340	0.46	8.48E-05	251	0.1298	32.6	218.4
chr25	10,796,843	0.47	5.94E-05	196	0.1163	22.8	173.2
chr25	12,505,768	0.56	3.67E-06	37	0.0381	1.4	35.6
chr25	16,774,570	0.43	0.00024	543	0.1698	92.2	450.8
chr25	27,500,973	0.48	4.86E-05	171	0.1092	18.7	152.3
chr26	1,644,926	0.49	4.07E-05	152	0.1027	15.6	136.4
chr26	5,069,050	0.44	0.000164	410	0.1534	62.9	347.1
chr26	6,233,825	0.44	0.000149	375	0.1528	57.3	317.7
chr26	13,081,639	0.45	0.000128	340	0.1445	49.1	290.9
chr26	17,824,119	0.47	7.30E-05	228	0.1230	28.0	200.0
chr26	24,224,498	0.47	7.18E-05	224	0.1231	27.6	196.4
chr26	24,870,576	0.54	6.51E-06	53	0.0472	2.5	50.5
chr26	31,673,797	0.42	0.000264	580	0.1745	101.2	478.8
chr26	31,776,289	0.42	0.000325	659	0.1896	125.0	534.0
chr26	41,907,585	0.47	7.26E-05	227	0.1229	27.9	199.1
chr26	42,272,014	0.42	0.000299	622	0.1847	114.9	507.1
chr26	42,739,445	0.51	1.96E-05	92	0.0817	7.5	84.5
chr26	46,445,295	0.43	0.000211	495	0.1640	81.2	413.8

chr26	51,052,896	0.43	0.000207	480.5	0.1655	79.5	401.0
chr27	2,163,510	0.48	5.09E-05	176	0.1110	19.5	156.5
chr27	8,045,070	0.47	7.69E-05	241	0.1225	29.5	211.5
chr27	11,865,711	0.51	2.23E-05	102	0.0841	8.6	93.4
chr27	12,908,976	0.42	0.000291	606	0.1843	111.7	494.3
chr27	15,635,658	0.41	0.000334	669	0.1919	128.4	540.6
chr27	16,390,456	0.47	7.55E-05	236	0.1229	29.0	207.0
chr27	18,995,621	0.43	0.000211	494	0.1641	81.1	412.9
chr27	32,064,196	0.49	3.79E-05	149	0.0978	14.6	134.4
chr27	33,587,697	0.42	0.000312	648	0.1847	119.7	528.3
chr27	36,409,643	0.49	3.30E-05	135	0.0939	12.7	122.3
chr27	42,982,487	0.41	0.000387	756	0.1966	148.6	607.4
chr27	44,723,449	0.43	0.00021	491	0.1645	80.8	410.2
chr27	46,278,403	0.42	0.000304	630	0.1855	116.9	513.1
chr28	665,881	0.42	0.00029	605	0.1840	111.3	493.7
chr28	11,686,824	0.49	3.24E-05	133	0.0934	12.4	120.6
chr28	11,821,292	0.48	5.55E-05	185	0.1152	21.3	163.7
chr28	14,528,442	0.41	0.000376	735	0.1965	144.5	590.5
chr28	15,258,075	0.48	4.43E-05	161	0.1056	17.0	144.0
chr28	15,789,180	0.54	6.12E-06	47	0.0500	2.3	44.7
chr28	19,308,861	0.41	0.000379	739	0.1970	145.6	593.4
chr28	24,390,433	0.41	0.000379	741	0.1966	145.7	595.3
chr28	25,433,932	0.43	0.000214	499	0.1645	82.1	416.9
chr28	29,043,204	0.43	0.000207	479	0.1660	79.5	399.5
chr28	31,891,510	0.44	0.000166	414	0.1539	63.7	350.3
chr28	44,281,987	0.41	0.000386	753	0.1967	148.1	604.9
chr29	838,714	0.50	2.86E-05	120	0.0914	11.0	109.0
chr29	16,070,511	0.41	0.000327	660	0.1900	125.4	534.6
chr29	16,211,280	0.42	0.000281	596	0.1808	107.8	488.2
chr29	17,894,859	0.45	0.000117	321	0.1396	44.8	276.2
chr29	23,385,814	0.51	2.09E-05	98	0.0820	8.0	90.0
chr29	28,045,239	0.44	0.000182	440	0.1591	70.0	370.0
chr29	28,985,876	0.45	0.000134	351	0.1462	51.3	299.7
chr29	32,403,643	0.58	1.55E-06	19	0.0313	0.6	18.4
chr29	35,629,013	0.42	0.000308	641	0.1847	118.4	522.6
chr29	36,749,135	0.44	0.000188	447	0.1613	72.1	374.9
chr29	38,394,032	0.54	6.43E-06	52	0.0475	2.5	49.5
chr29	38,419,695	0.55	5.60E-06	45	0.0478	2.2	42.8
chr29	38,483,436	0.58	1.29E-06	18	0.0275	0.5	17.5
chr29	38,496,312	0.49	3.74E-05	148	0.0970	14.4	133.6
chr29	38,509,122	0.44	0.00015	376	0.1533	57.6	318.4
chr29	38,521,847	0.53	1.12E-05	69	0.0624	4.3	64.7

chr29	38,540,999	0.43	0.000192	454	0.1626	73.8	380.2
chr29	38,566,732	0.50	2.59E-05	115	0.0865	9.9	105.1
chr29	44,557,080	0.44	0.000147	369	0.1527	56.4	312.6
chrX	8,985,725	0.45	0.000131	345	0.1459	50.3	294.7
chrX	16,544,233	0.42	0.000257	569	0.1737	98.9	470.1
chrX	21,344,386	0.43	0.000216	503	0.1649	82.9	420.1
chrX	21,555,379	0.53	8.39E-06	57	0.0565	3.2	53.8
chrX	24,608,202	0.43	0.00023	525	0.1681	88.2	436.8
chrX	28,985,956	0.43	0.000235	535	0.1689	90.4	444.6
chrX	30,880,089	0.46	0.000102	285	0.1372	39.1	245.9
chrX	42,150,835	0.41	0.00034	679	0.1923	130.5	548.5
chrX	43,308,914	0.41	0.000363	709	0.1965	139.3	569.7
chrX	46,605,171	0.43	0.000221	512	0.1661	85.1	426.9
chrX	47,821,197	0.46	8.90E-05	260	0.1315	34.2	225.8
chrX	53,101,191	0.45	0.000112	311	0.1378	42.9	268.1
chrX	54,764,868	0.57	1.91E-06	21	0.0349	0.7	20.3
chrX	74,534,482	0.41	0.000375	731	0.1968	143.9	587.1
chrX	75,706,063	0.47	7.85E-05	245	0.1231	30.2	214.8
chrX	85,222,834	0.49	4.26E-05	155	0.1055	16.4	138.6

Figure S1. Cattle copy number variation and segmental duplication regions display a local tandem distribution pattern. All CNV regions are shown above the chromosomes in green (gain), red (loss) and dark blue (both). The bar height represents their frequencies: short (appeared in 1 sample), median (≥ 2 samples) and tall (≥ 5 samples). Segmental duplications (94.4 Mb, 3.1% of the bovine genome) predicted by two independent computational approaches are illustrated on the chromosomes in red (WSSD), blue (WGAC) or purple (both). The patterns are depicted for all duplications for ≥ 5 kb in length and, ≥ 90% sequence identity. The gaps in the assembly are represented on the chromosomes as white ticks.

Figure S2. Correlation of PCR results with array CGH log2 relative ratios. We tested significant correlation between qPCR results and array GCH data using 100,000 times Monte Carlo simulations after adjust for multiple testing. The 1% and 5% significant levels are represented by dashed and dotted lines. The asterisks represent PCR locations. See Method for details.

Figure S3. Heatmap representation of cattle CNVs. Each row represents one of the 177 non-redundant CNV regions and columns correspond to 90 animals. For each CNV region, bars are labelled as black, red, and green, depending on whether the individual showed no copy number variation, a loss, or a gain, respectively. CNV regions that show both a loss and a gain within an individual sample (see text) are labelled yellow. Horizontal white lines separate CNV calls from losses, gains and both. Within each class, CNV regions are sorted from low to high frequency and from left to right cattle are sorted by decreasing number of CNVs.

Figure S4. Genes and mapping of *ULBP* major cluster. We mapped *ULBP* major cluster sequence (DP000081.1 derived from Holstein BACs of RP42 library) on Btau_4.0 and found it has significant sequence similarity in CNVR56 on chr9 and two unplaced contigs on chrUn (>98%, 1kb). *ULBP* gene family numbers are labelled as red (pseudogene) and blue (gene). The numbers of those genes overlapping with chr9 were raised (7, 9, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 2, 29, 30, and 31). Among them, *ULBP9, ULBP21, ULBP27* and *ULBP2* are potential functional copies. Only *ULBP2* and *ULBP21* are located in the major *ULBP* cluster while *ULBP9* and *ULBP27* in the minor *ULBP* cluster. Others are either partially overlapped (*ULBP17*) or pseudogenes.

Figure S5. Examples of interphase two-color FISH for 41 BAC clones. Increased signal intensity was confirmed using cohybridization with a unique control BAC clone (297K6, green) in the same nucleus. For summary, see also Table S8. Tandem distribution patterns were most frequently observed. The results of all FISH experiments are also available online at http://bfgl.anri.barc.usda.gov/cattleCNV/.

Figure S1. Cattle copy number variation and segmental duplication regions display a local tandem distribution pattern.

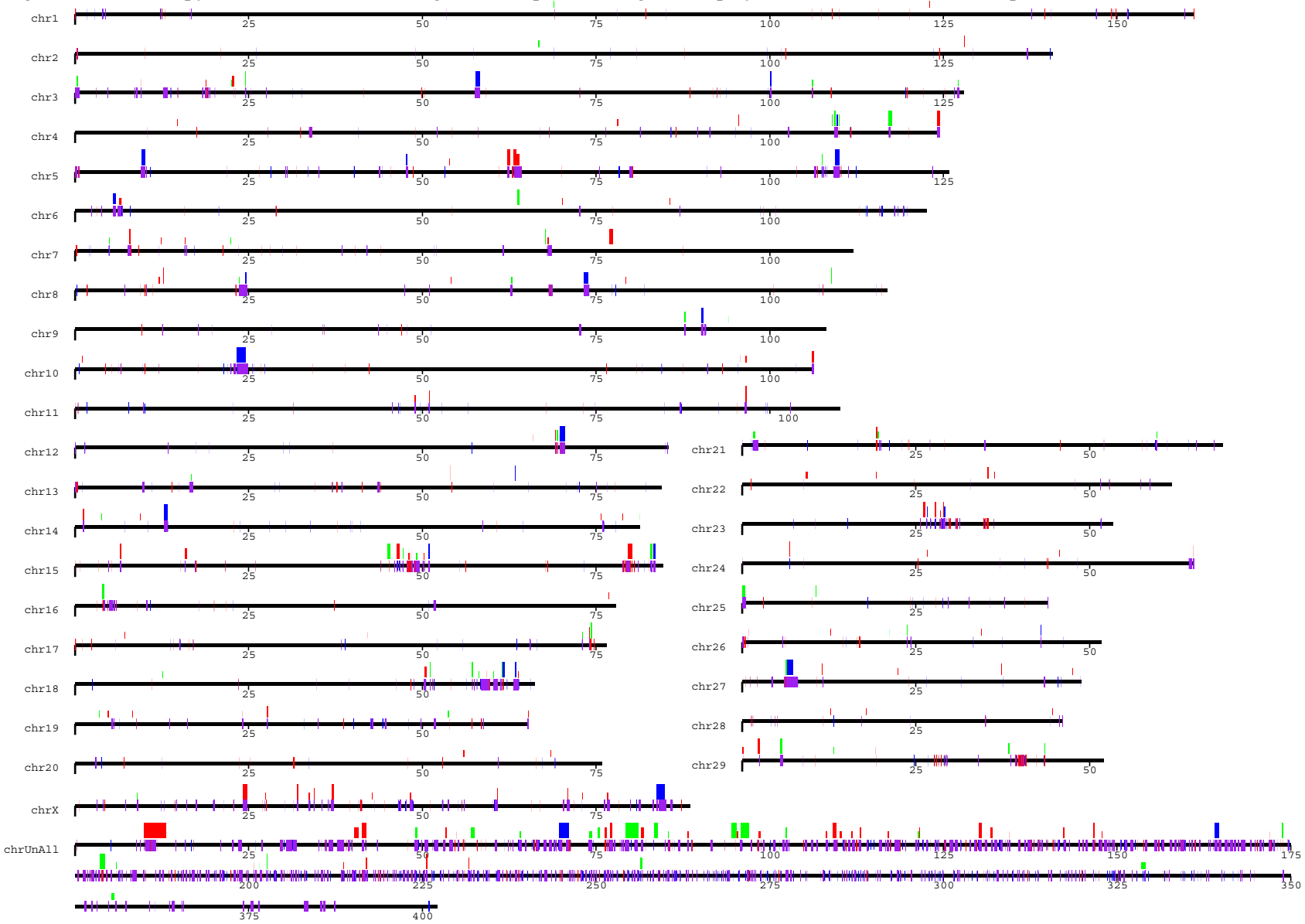
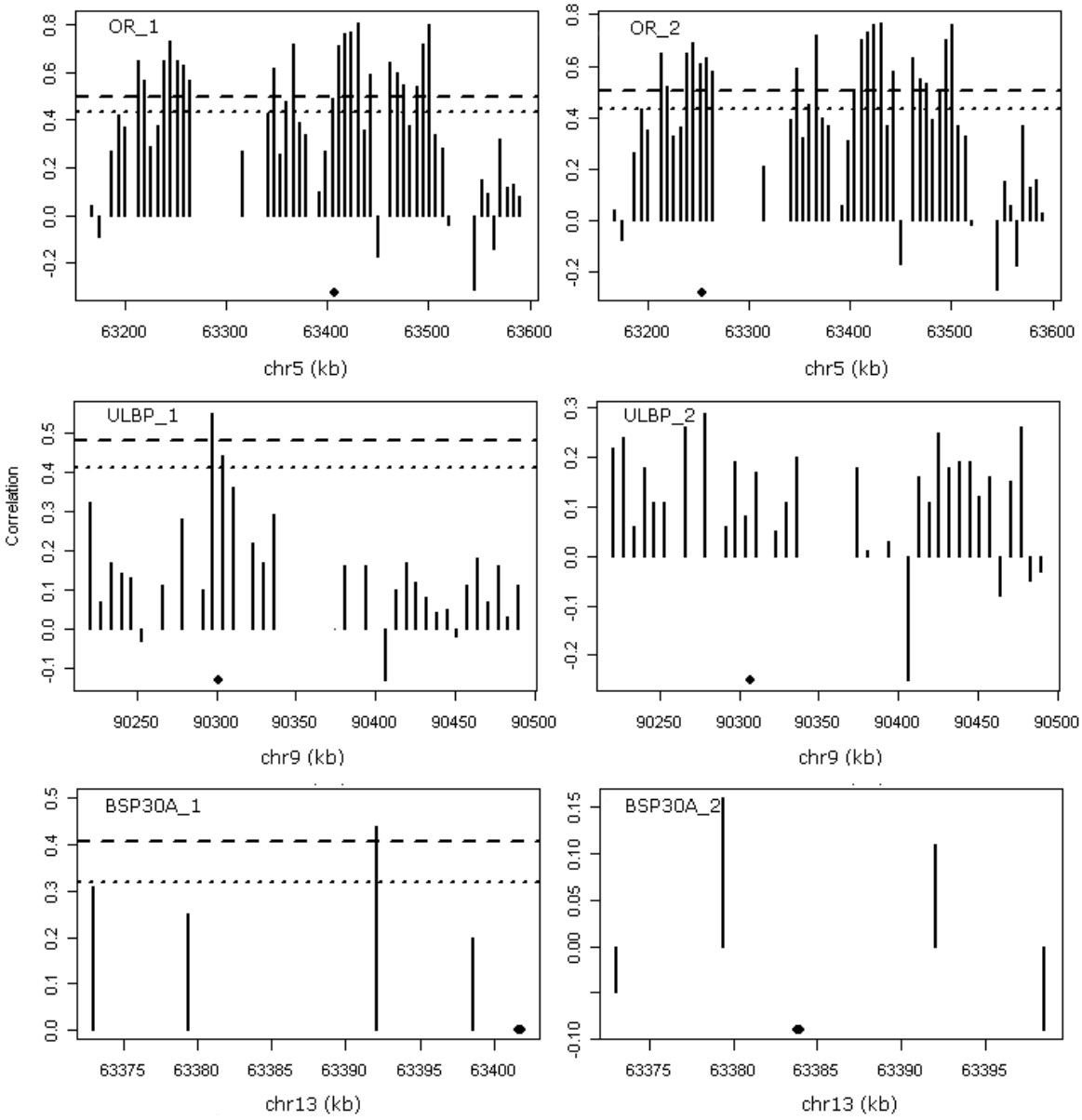


Figure S2. Correlation of PCR results with array CGH log2 relative ratios.



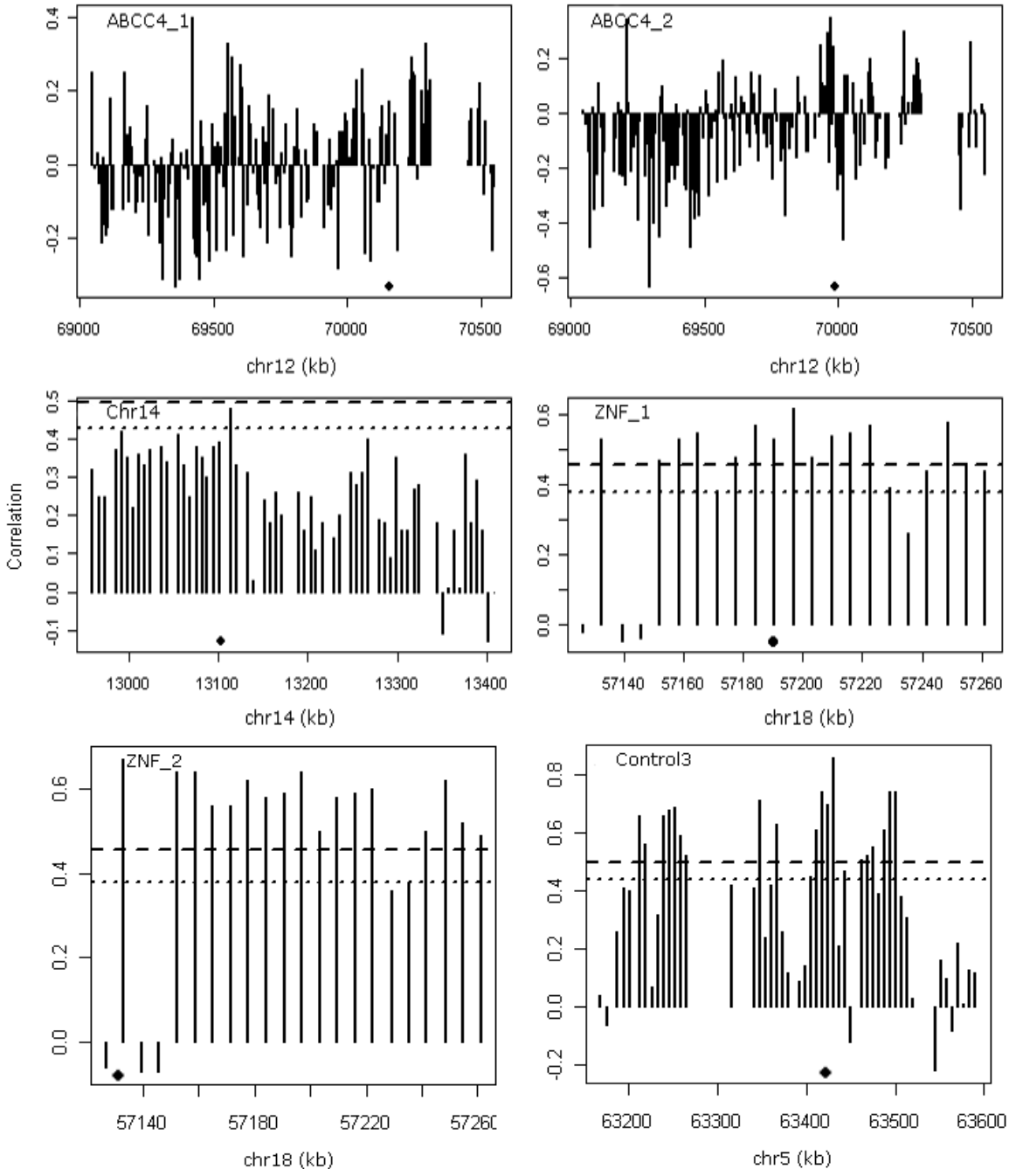

ABCC4_1
0.4
0.2
0.0
-0.2
69000
69500
70000
70500
chr12 (kb)
ABCC4_2
0.2
0.0
-0.2
-0.4
-0.6
69000
69500
70000
70500
chr12 (kb)
Correlation
Chr14
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
13000
13100
13200
13300
13400
chr14 (kb)
ZNF_1
0.6
0.4
0.2
0.0
57140
57160
57180
57200
57220
57240
57260
chr18 (kb)
ZNF_2
0.6
0.4
0.2
0.0
57140
57180
57220
chr18 (kb)
Control3
0.8
0.6
0.4
0.2
0.0
-0.2
63200
63300
63400
63500
63600
chr5 (kb)

Figure S3. Heatmap representation of cattle CNVs.

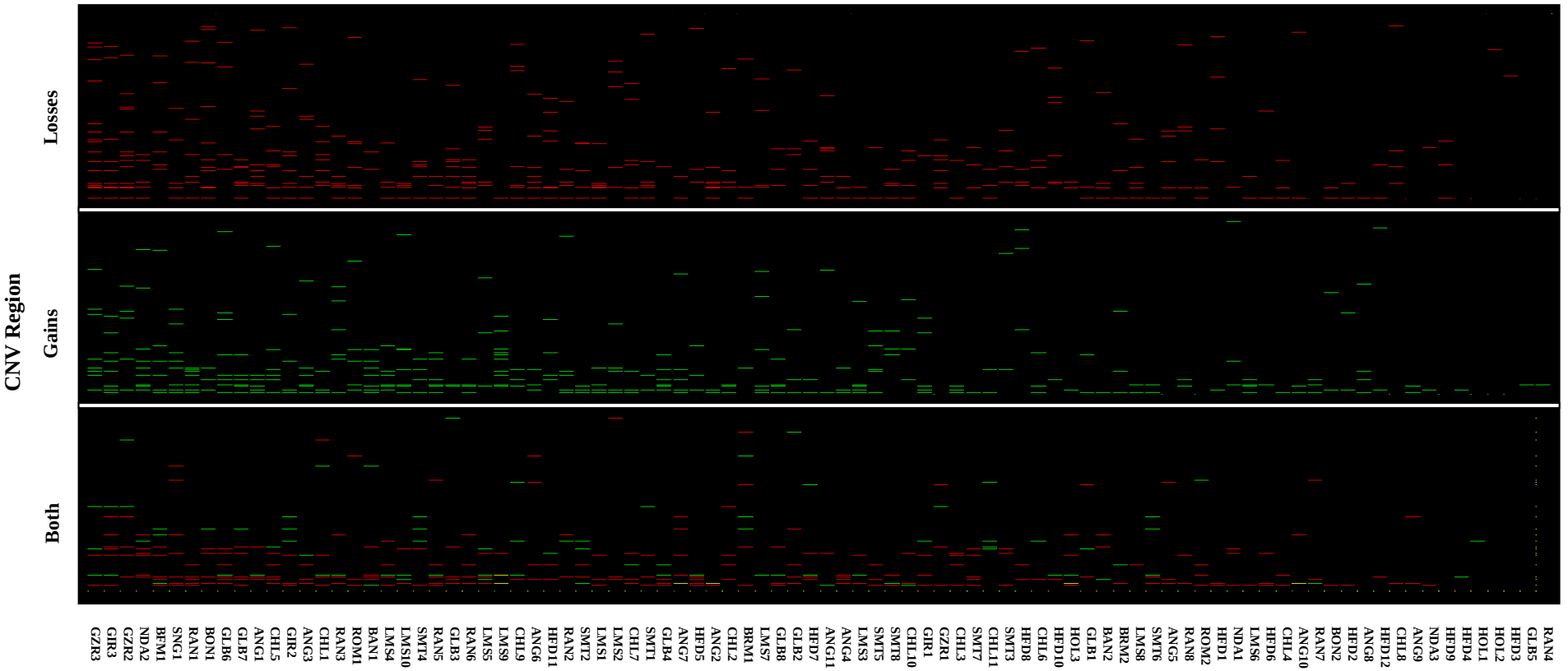


Figure S4. Genes and mapping of *ULBP* major cluster.

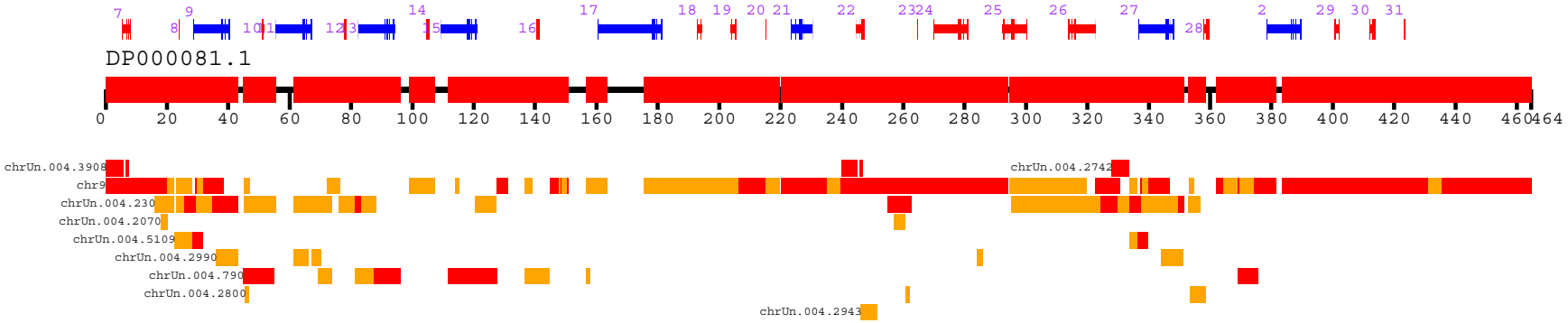
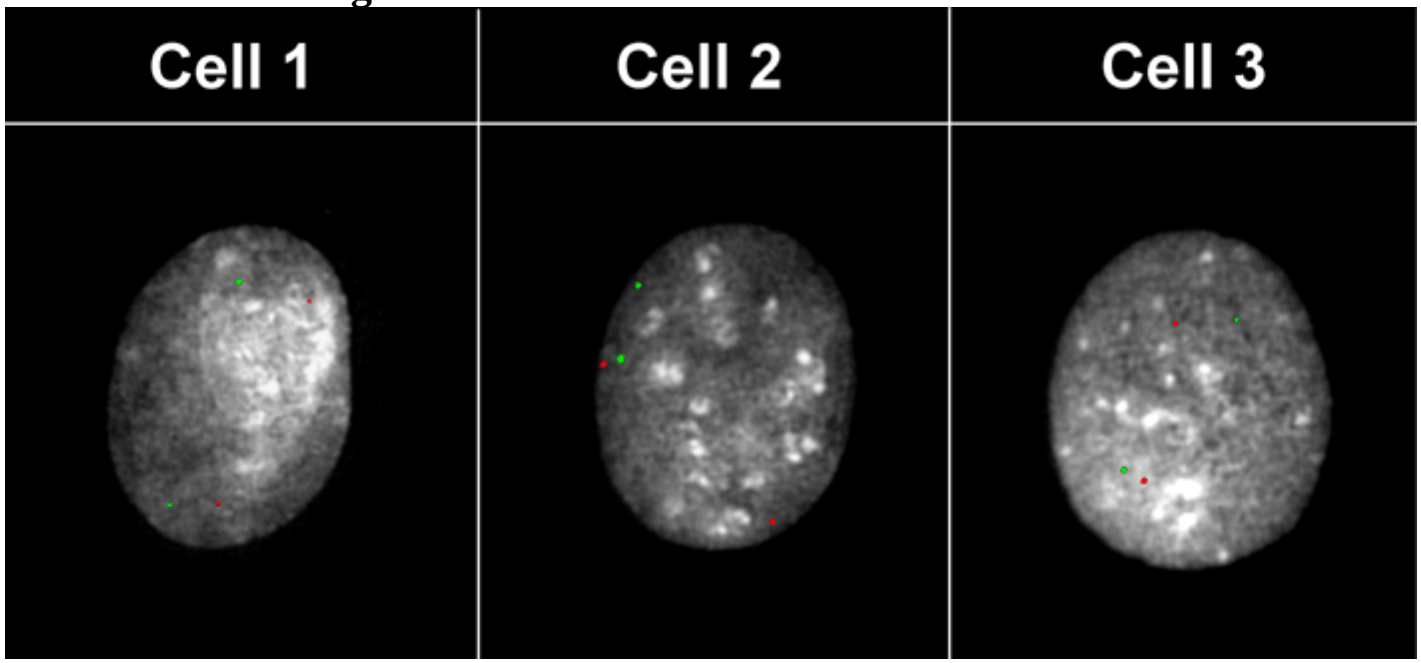
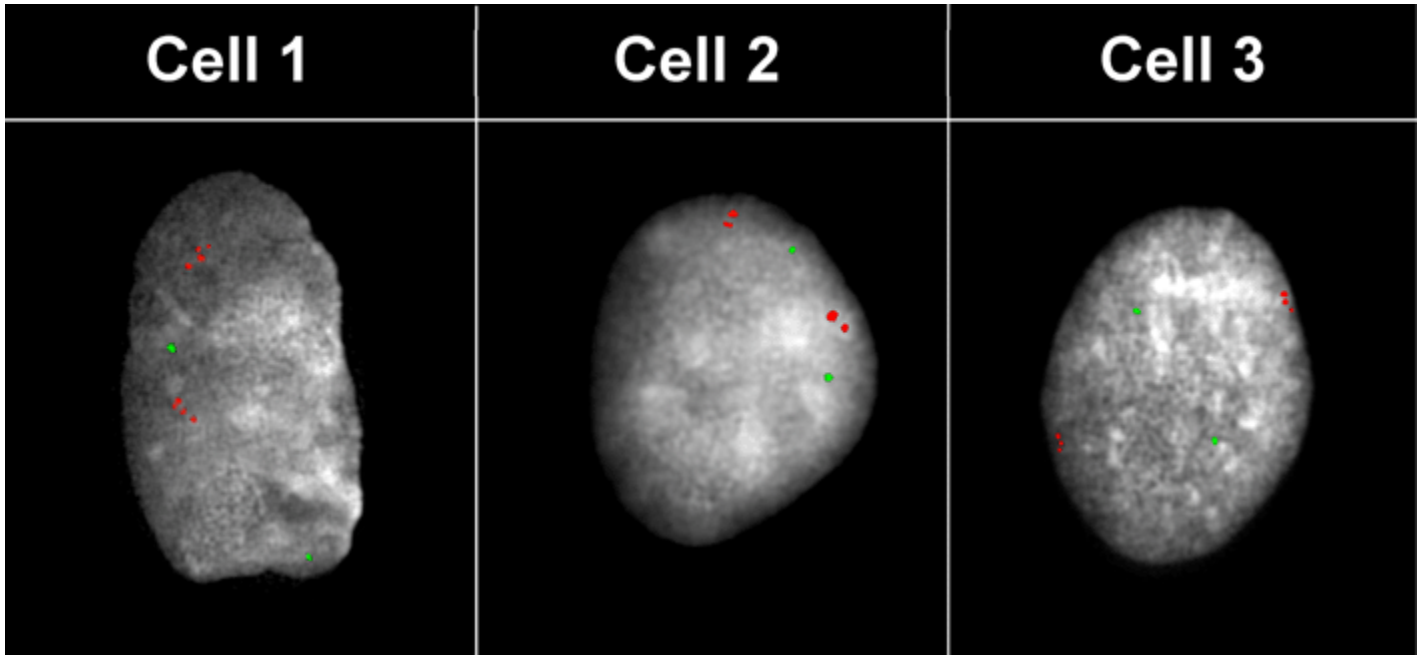


Figure S5. Examples of interphase two-color FISH for 41 BAC clones

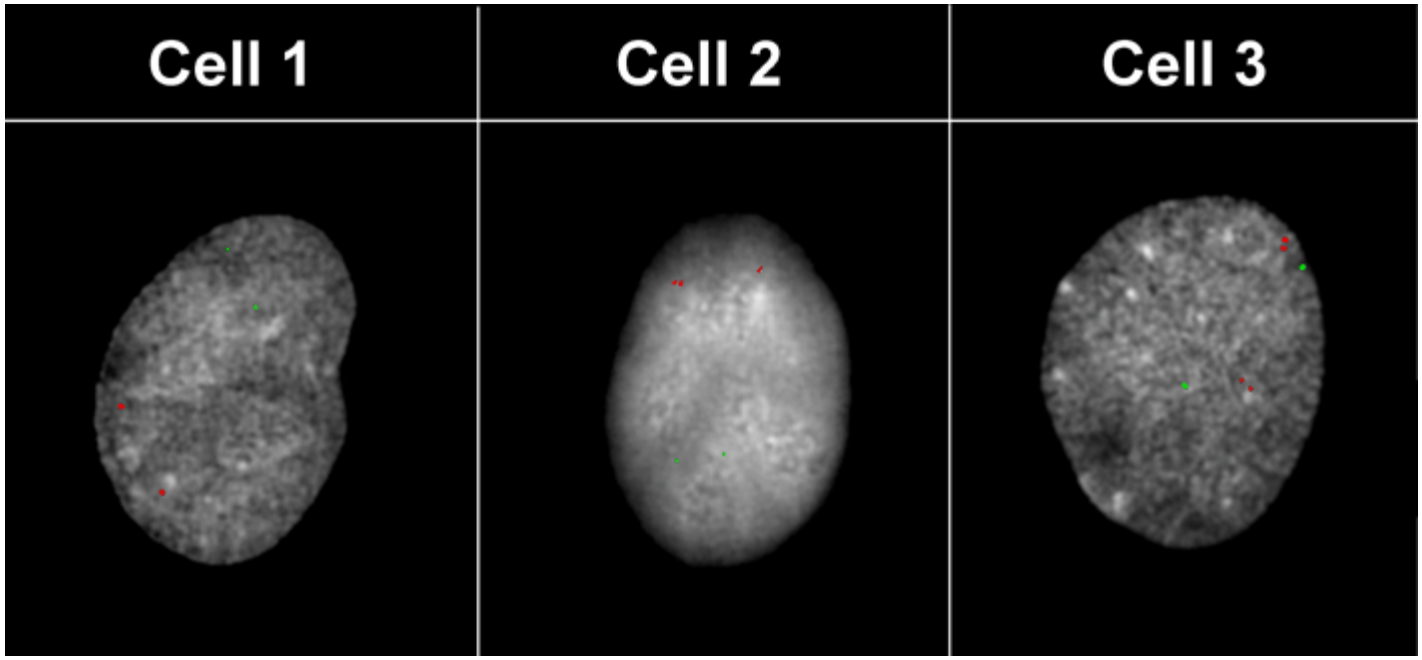
1. 327J13: No change



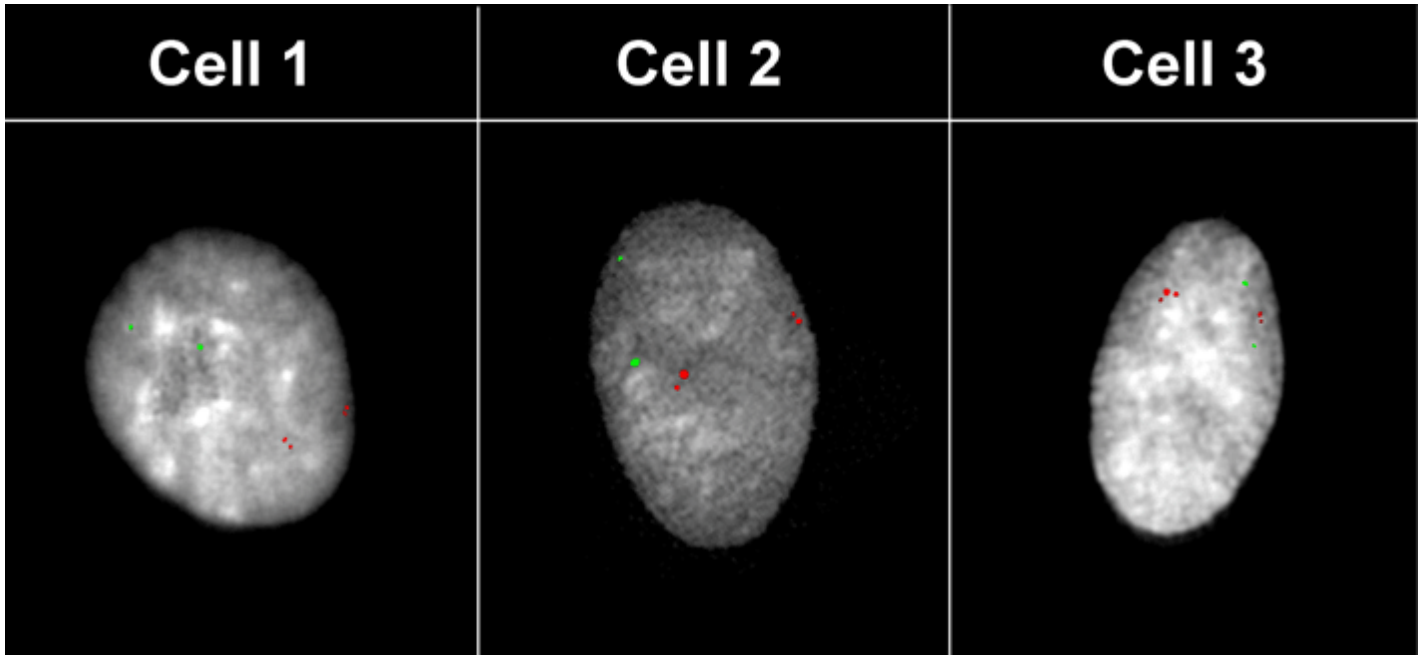
2. 271E1: Yes



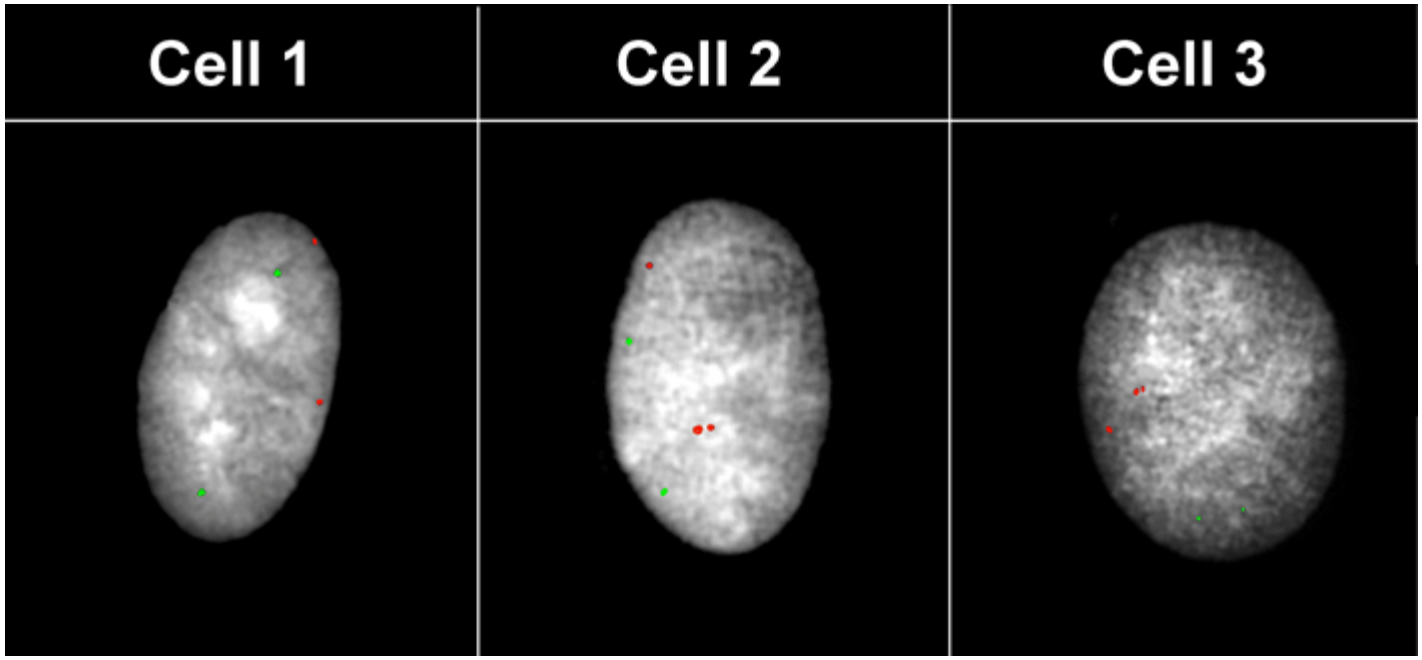
3. 259A24: Yes



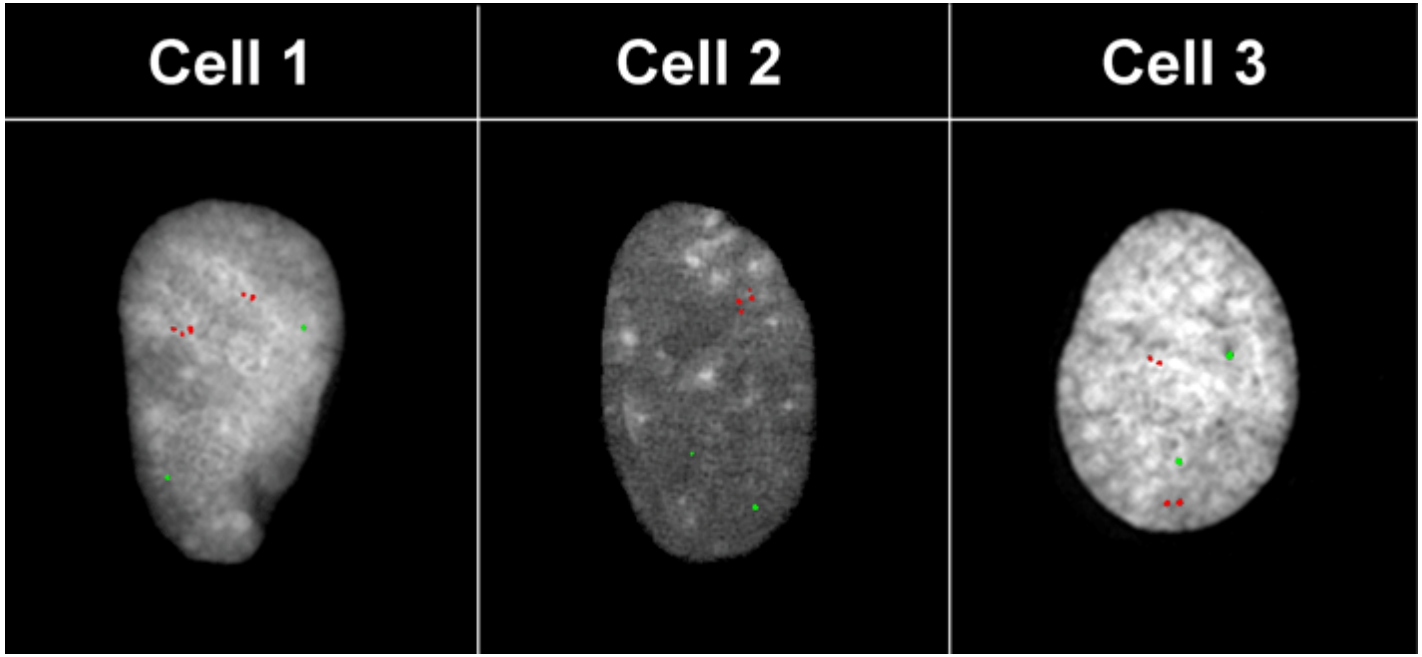
4. 234E12: Yes



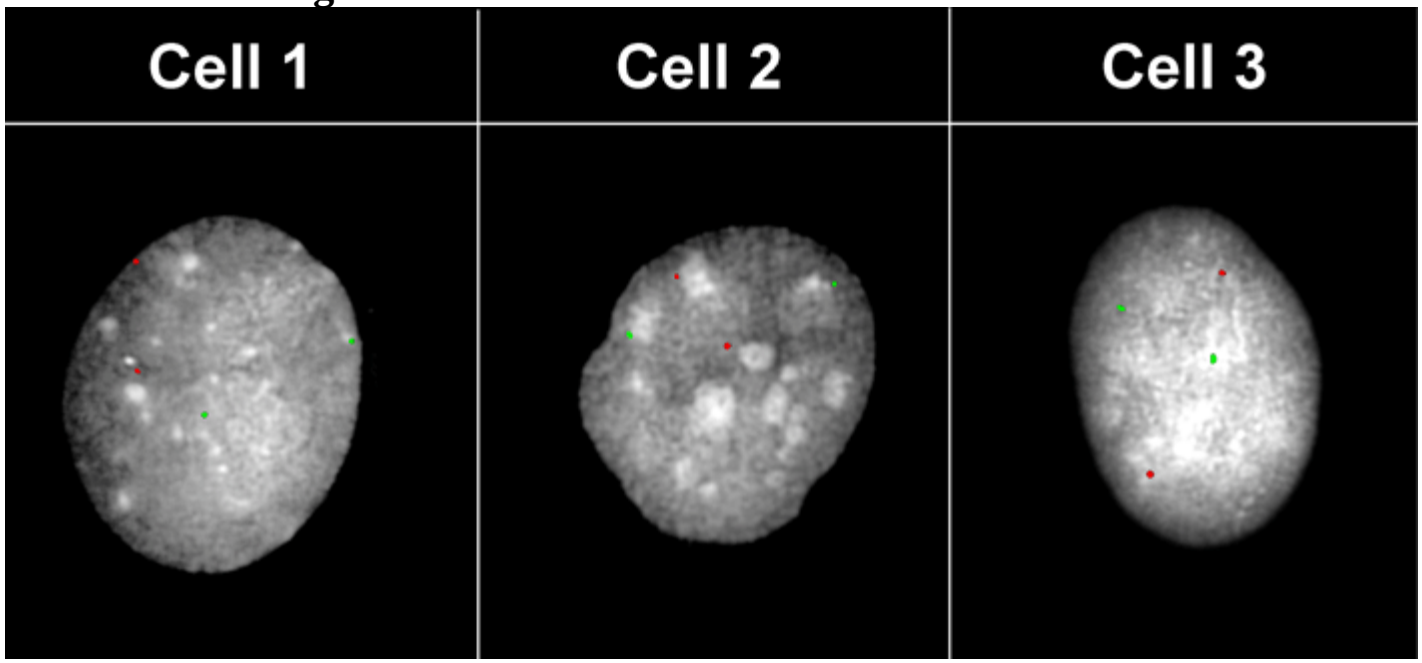
5. 121O22: **Yes**



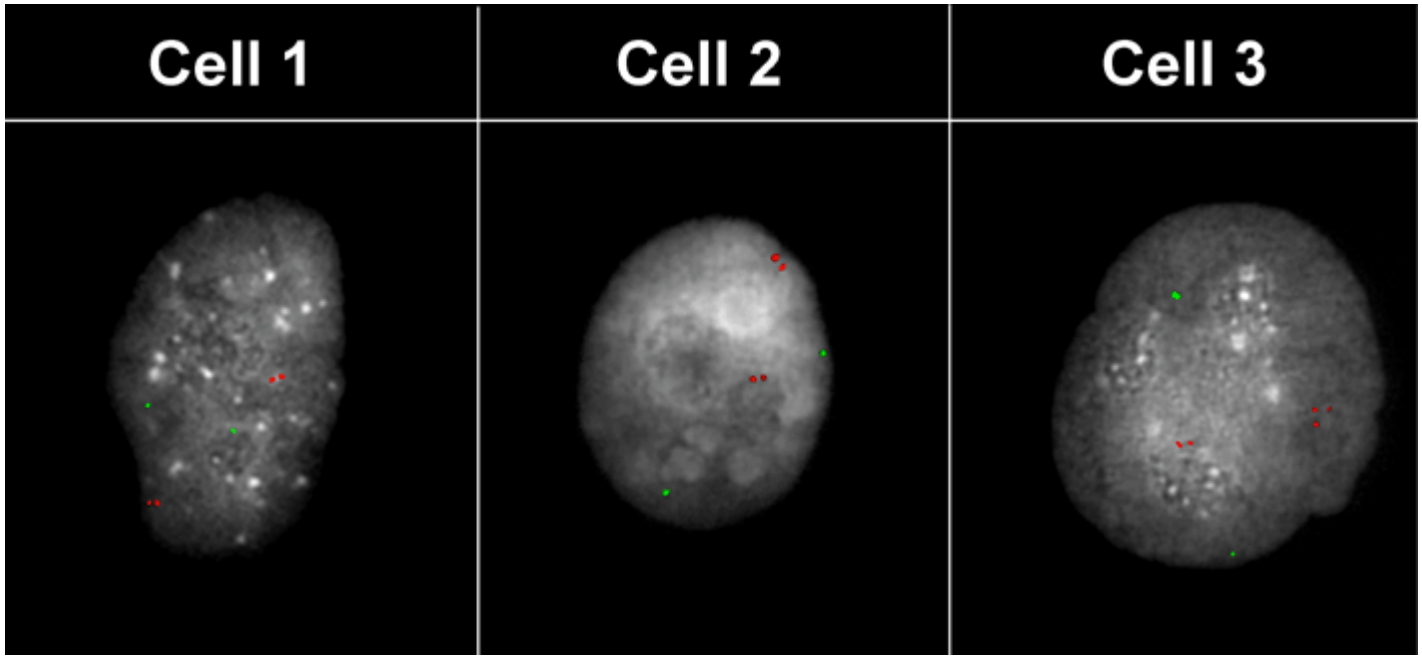
6. 203K5: Yes



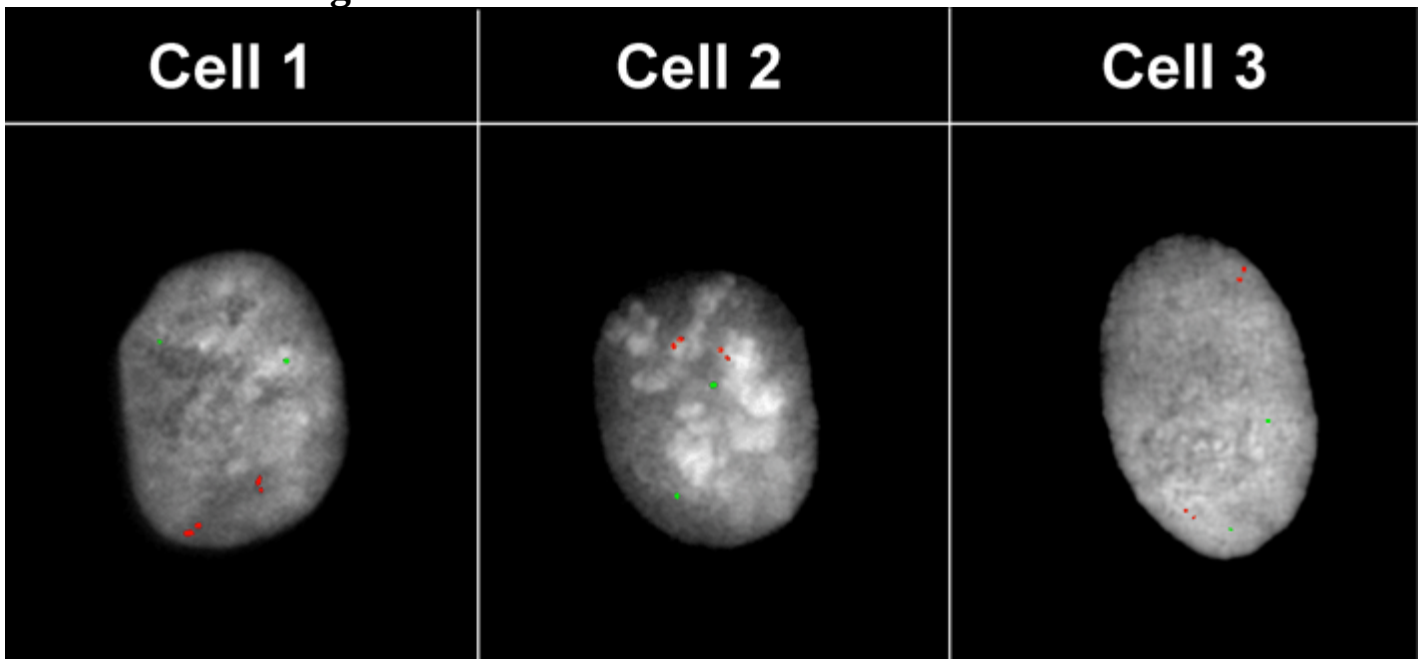
7. 23F3: No change



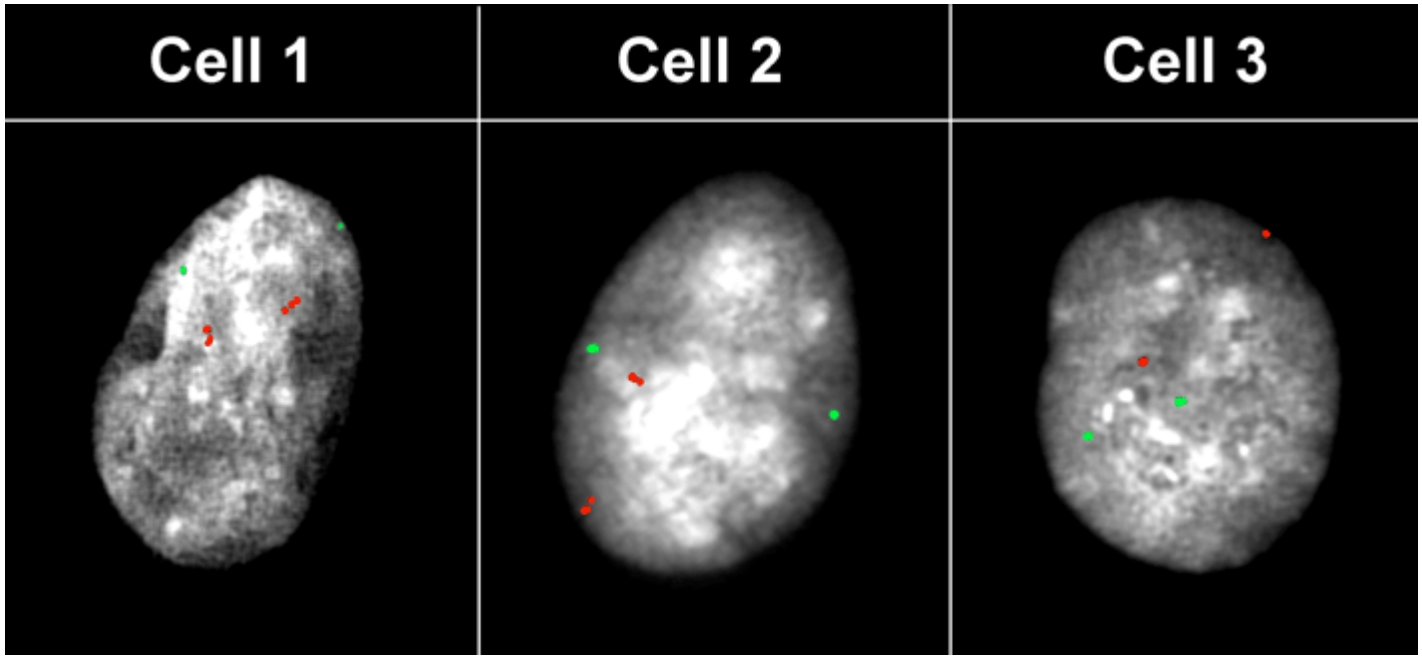
8. 69N13: Yes



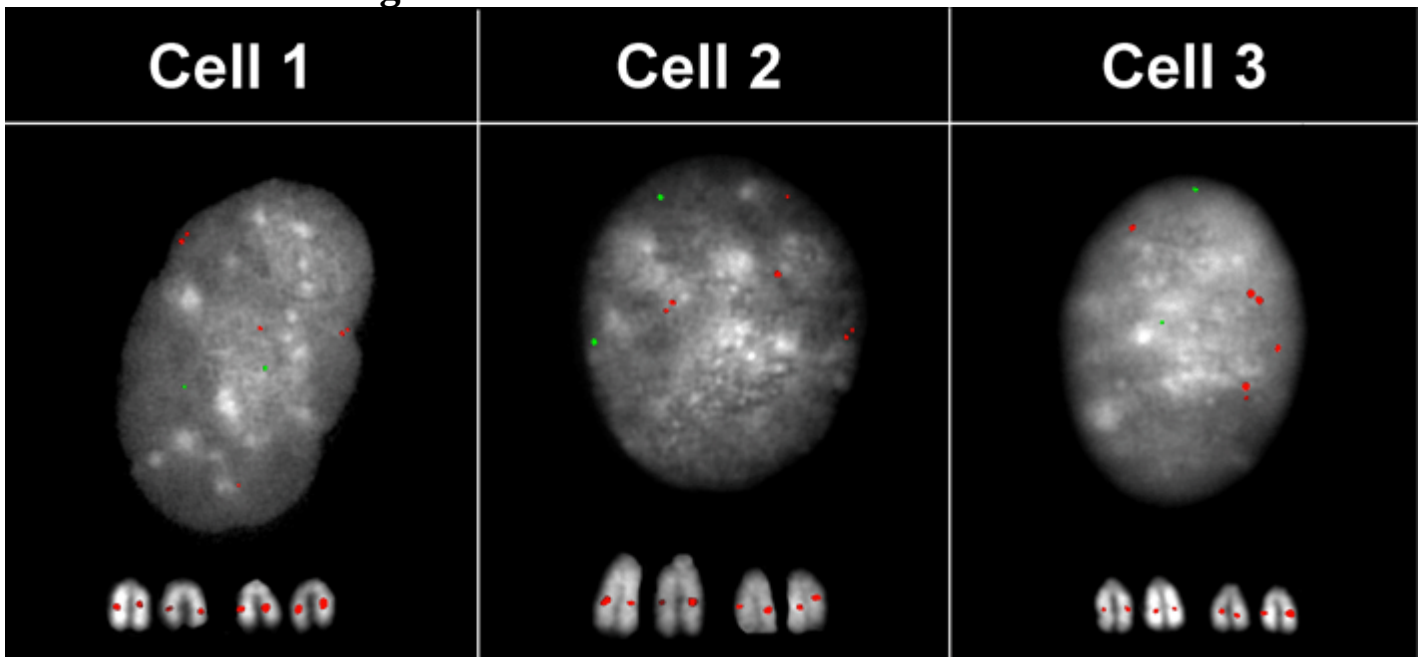
9. 70J17: No change



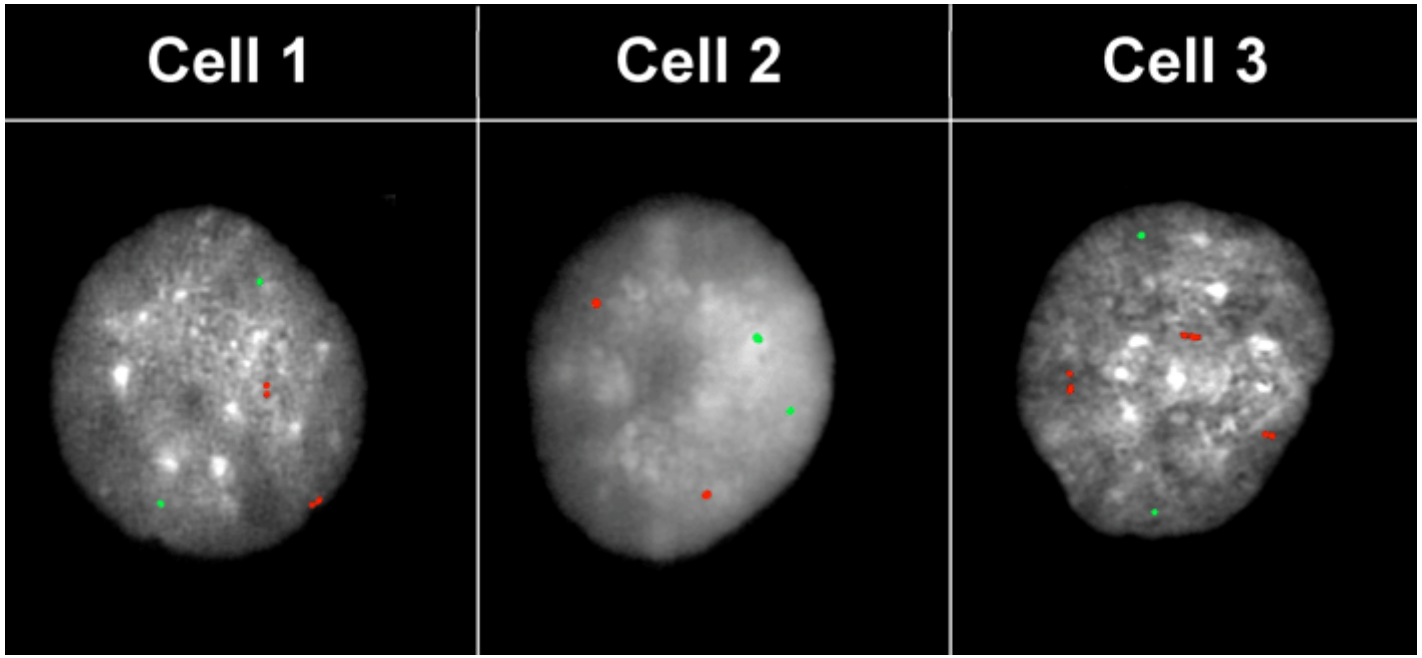
10. 143A4: Yes



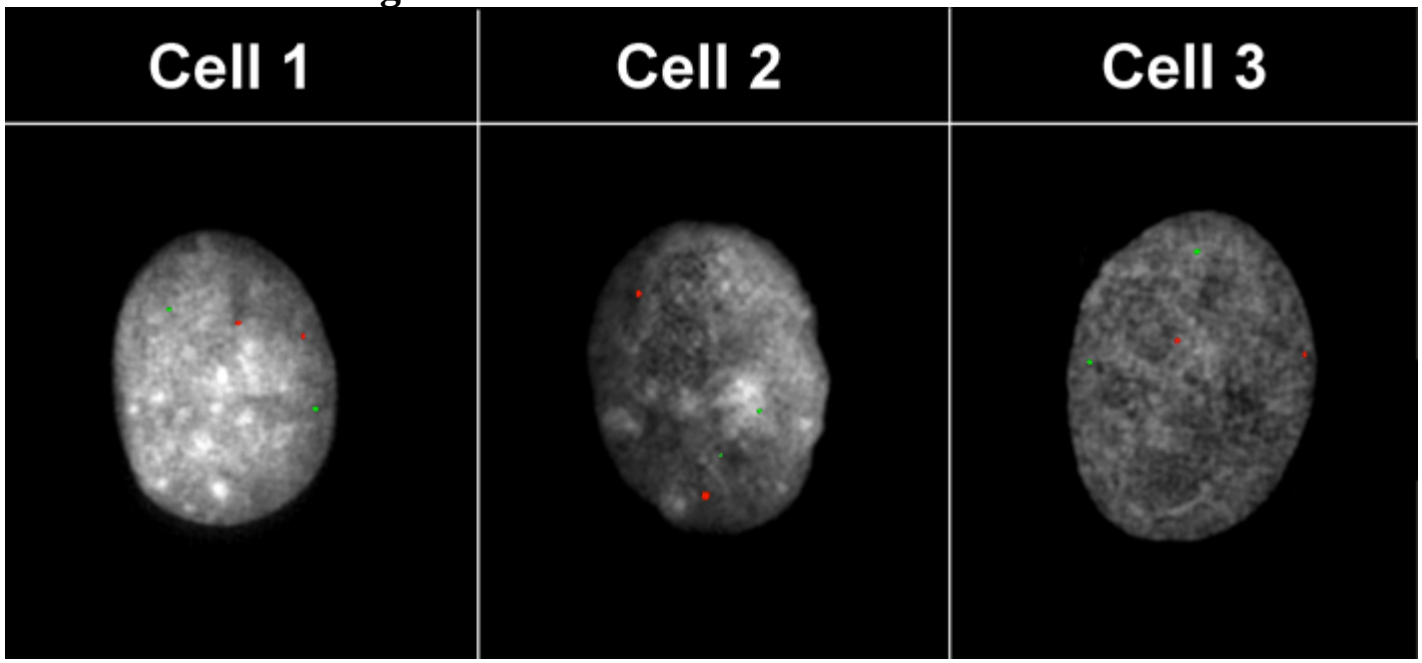
11. 263E19: No change



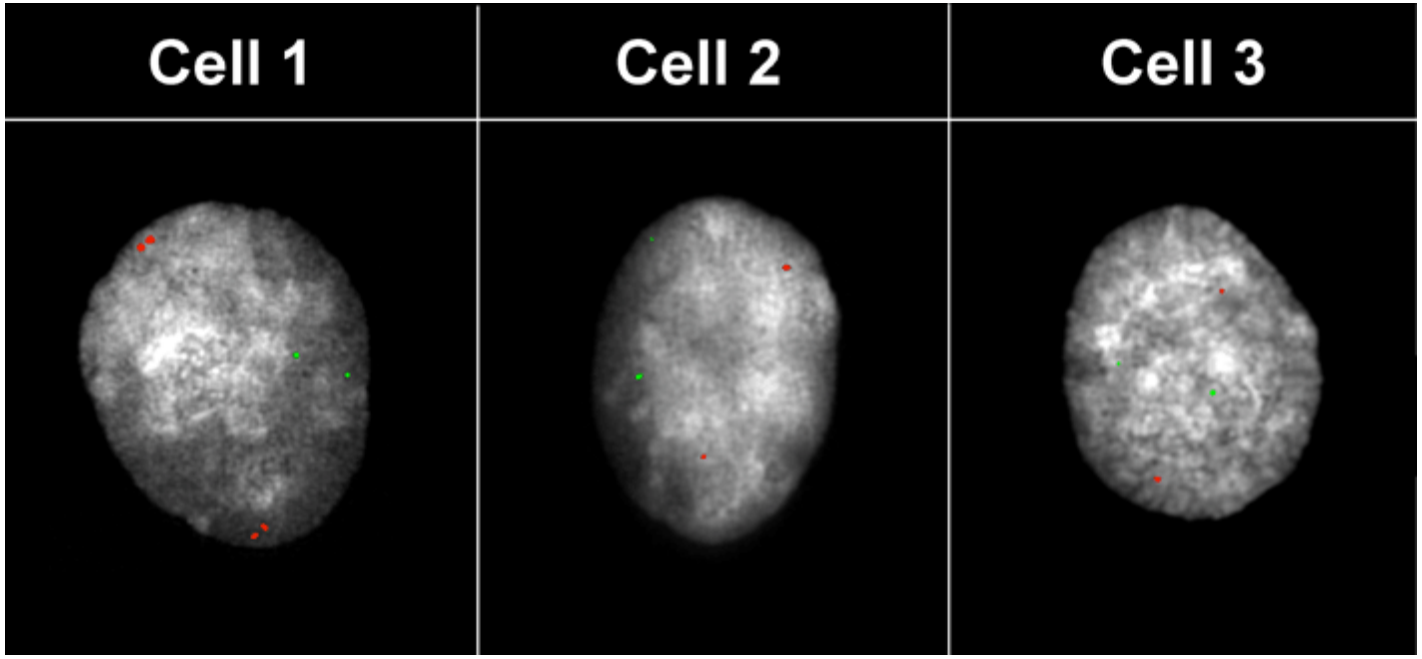
12. 324F20: Yes



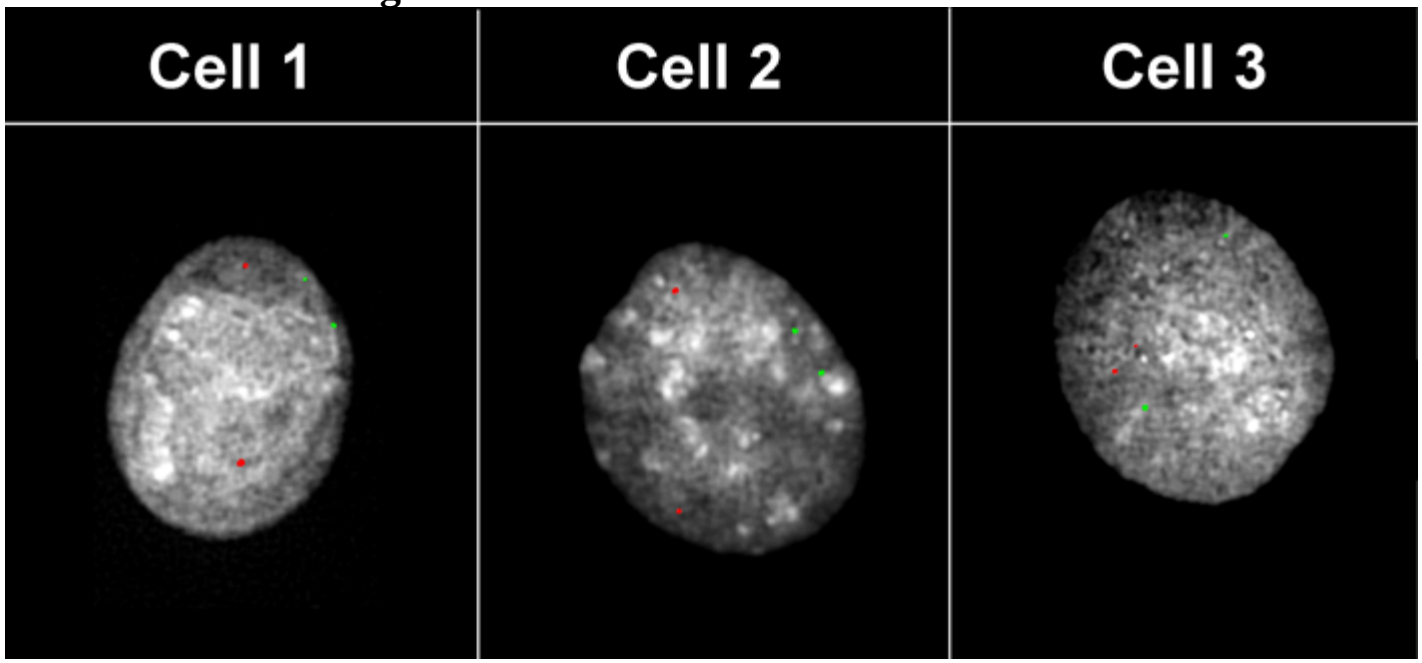
13. 461E16: No change



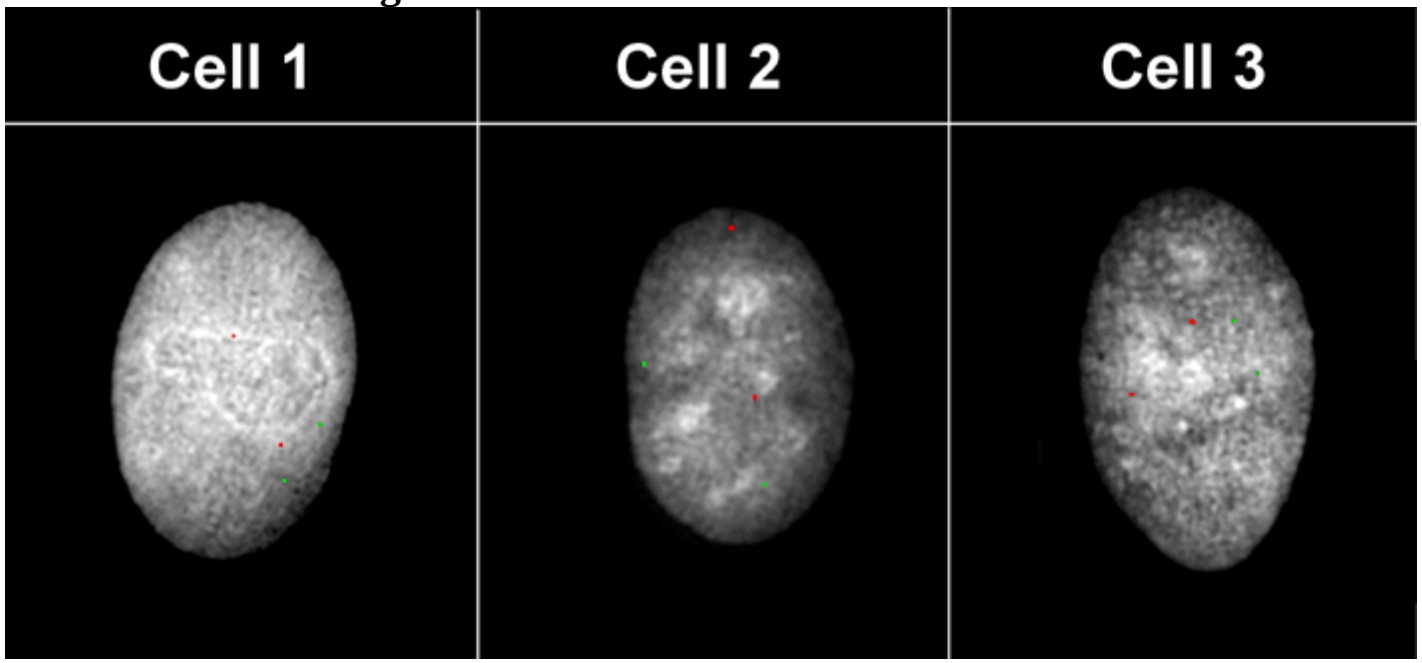
14. 343H7: Yes



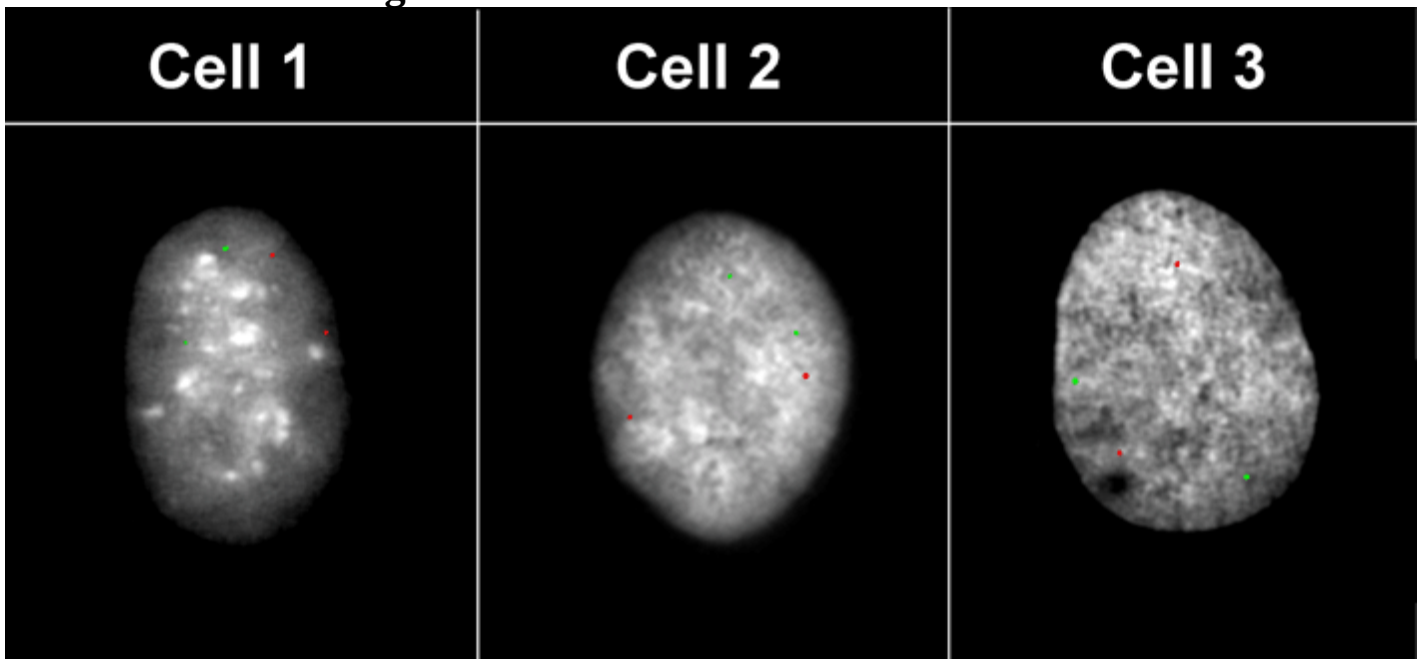
15. 149E13: No change



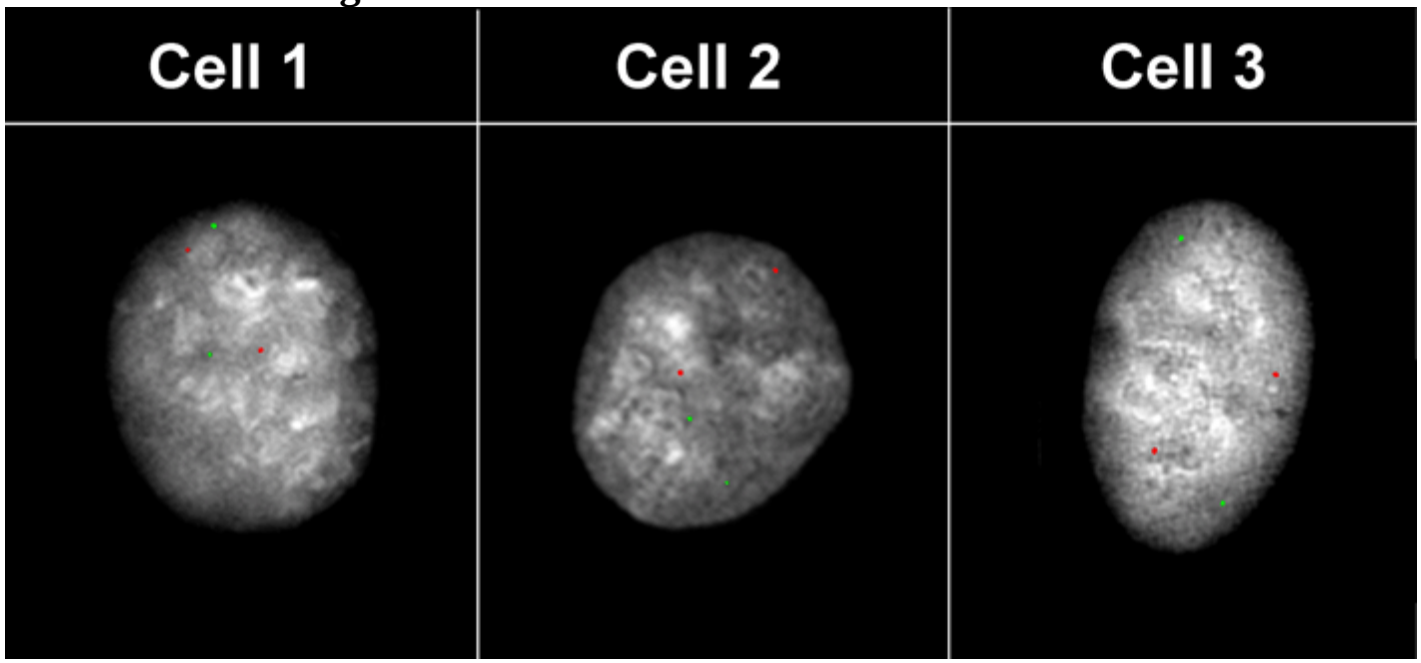
16. 124L13: No change



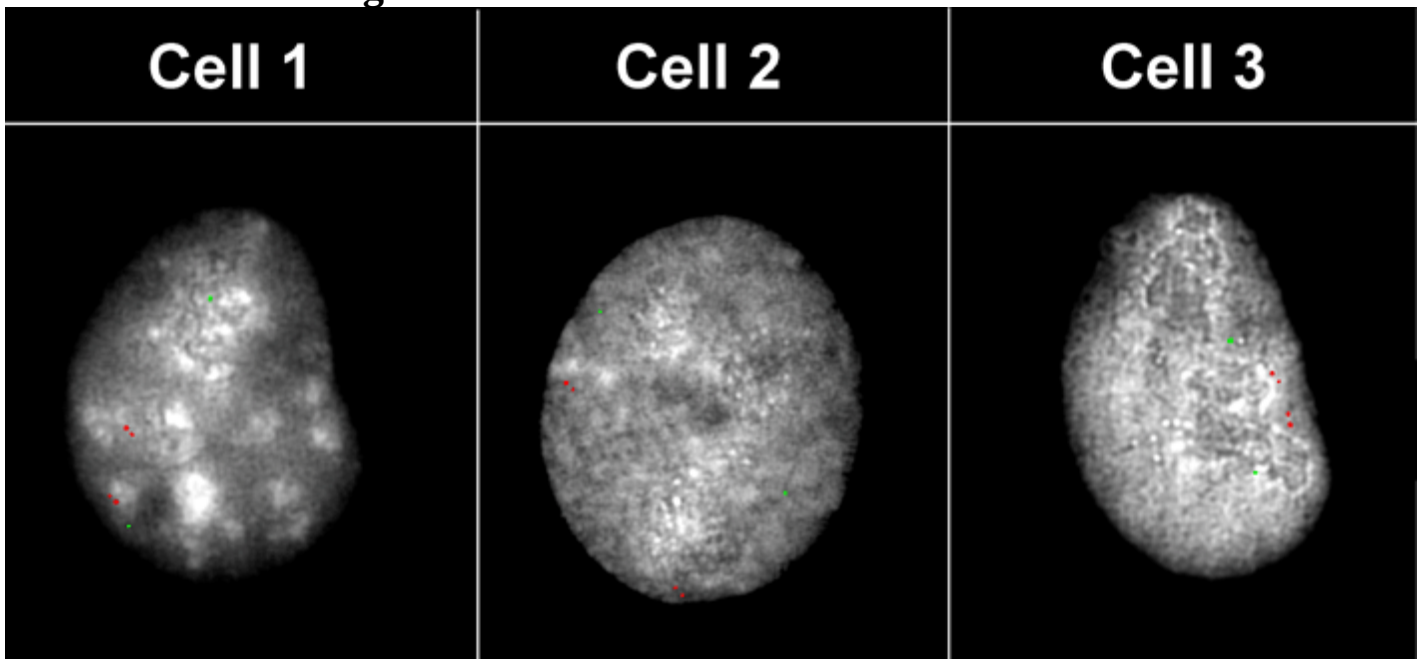
17. 490G14: No change



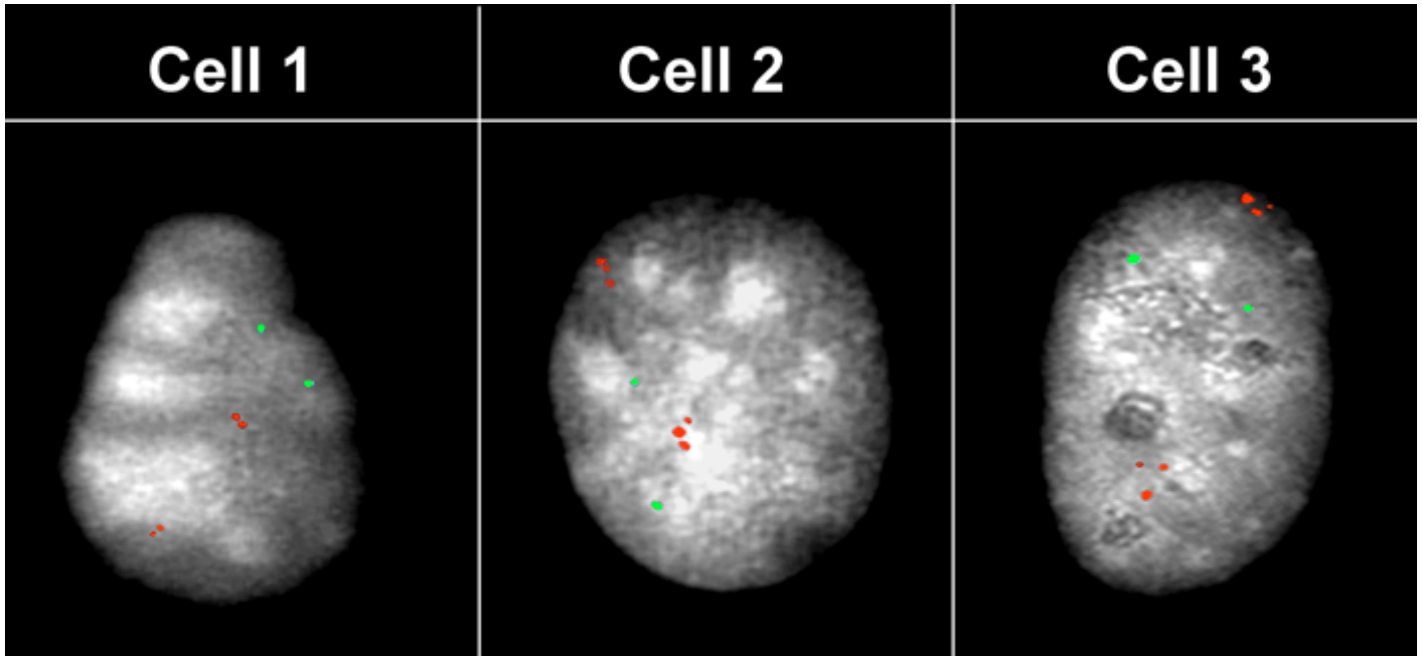
18. 7N20: No change



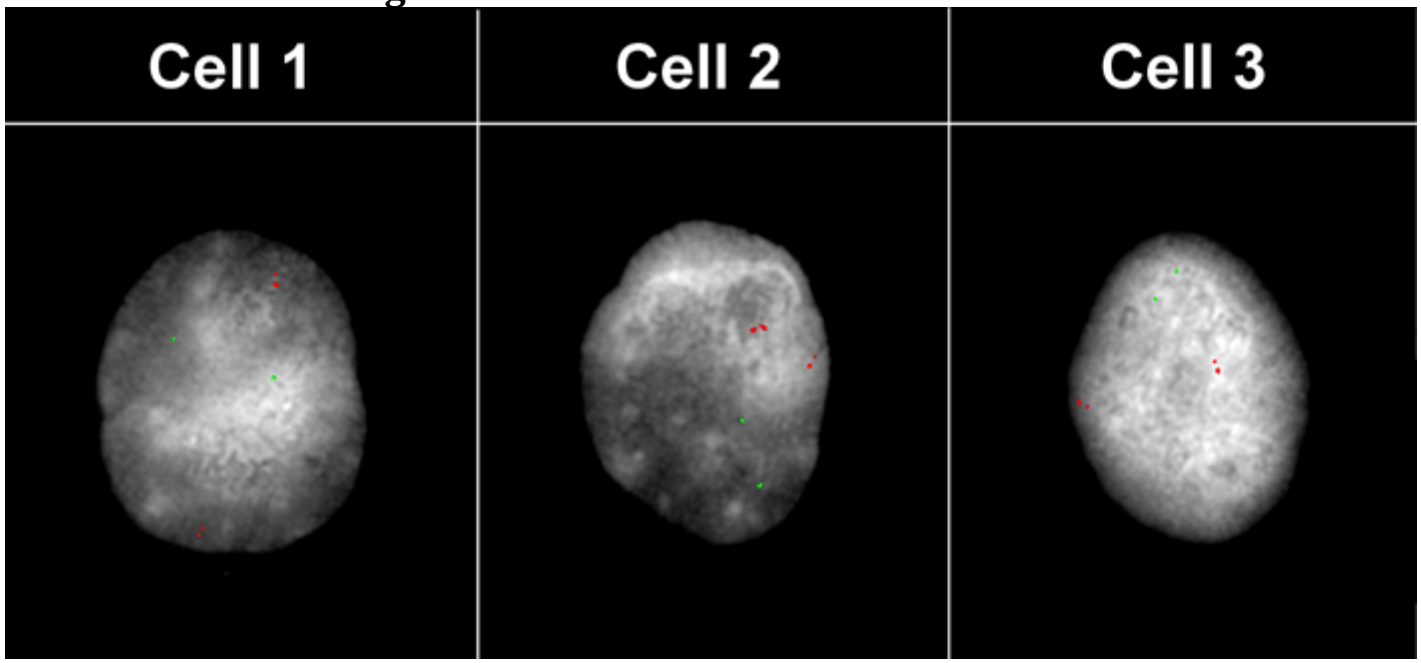
19. 456G8: No change



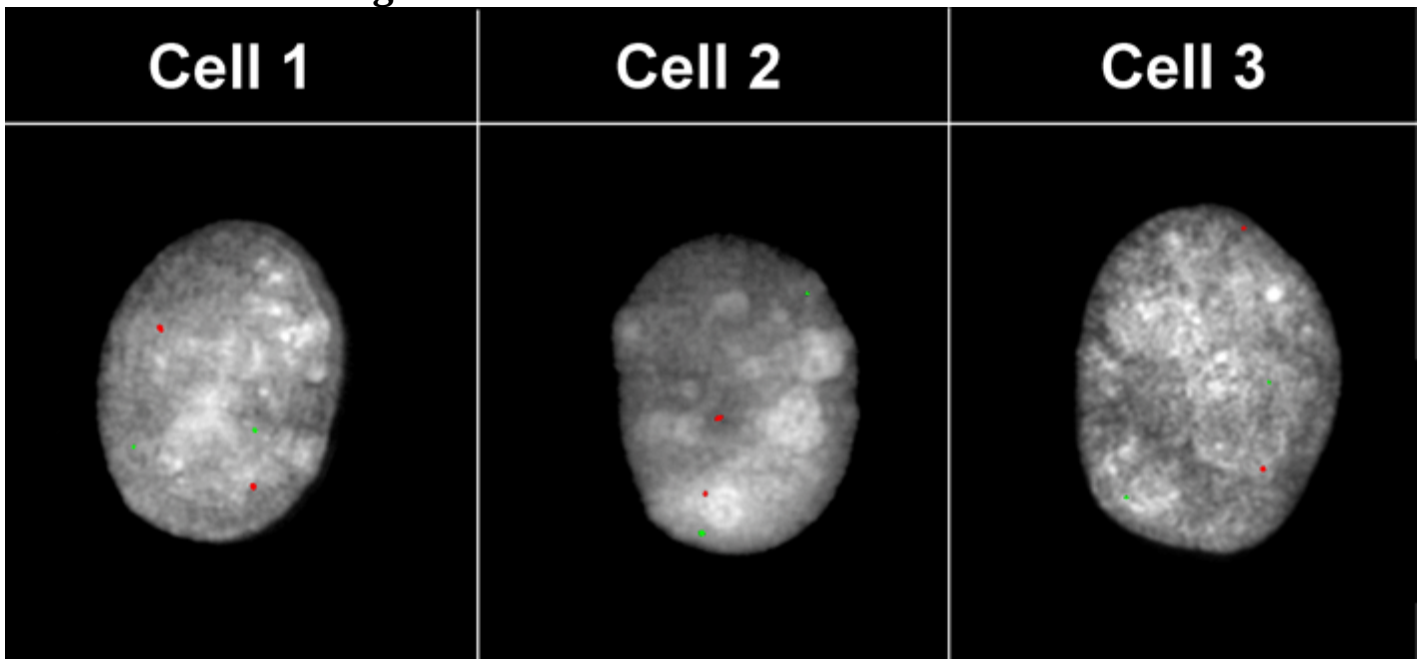
20. 259A1: Yes



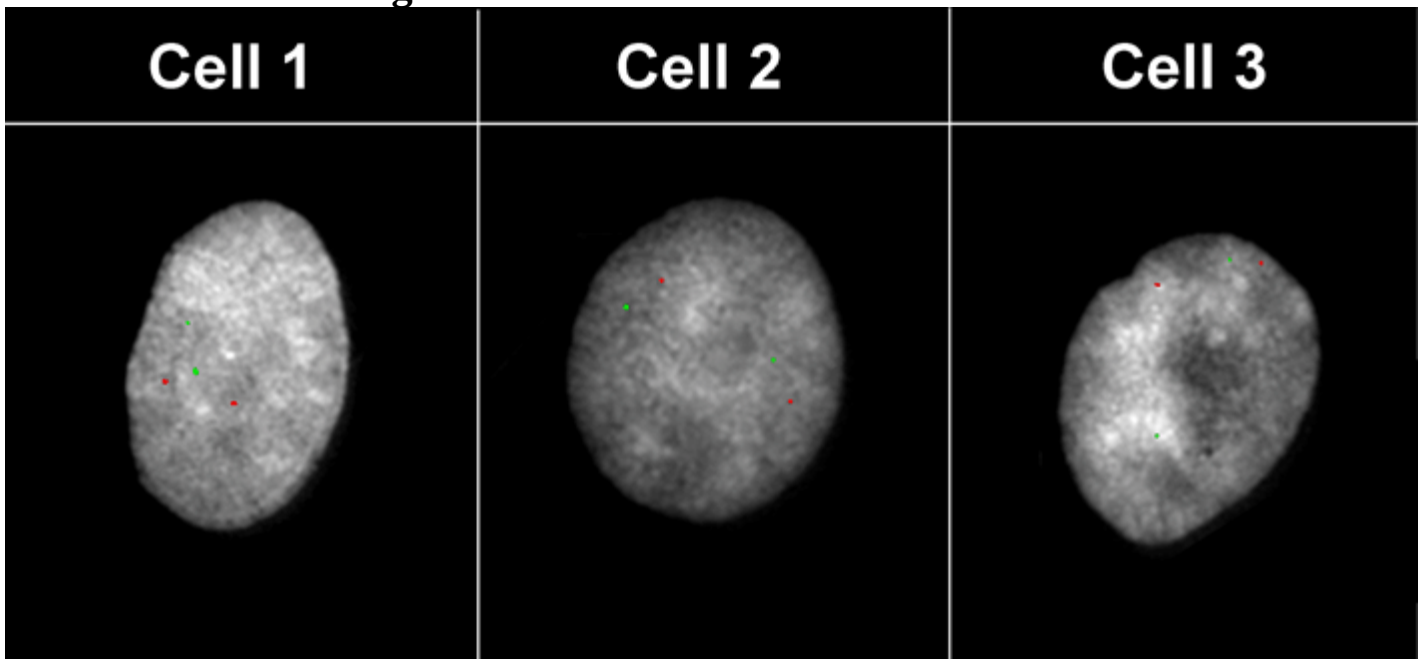
21. 175G10: No change



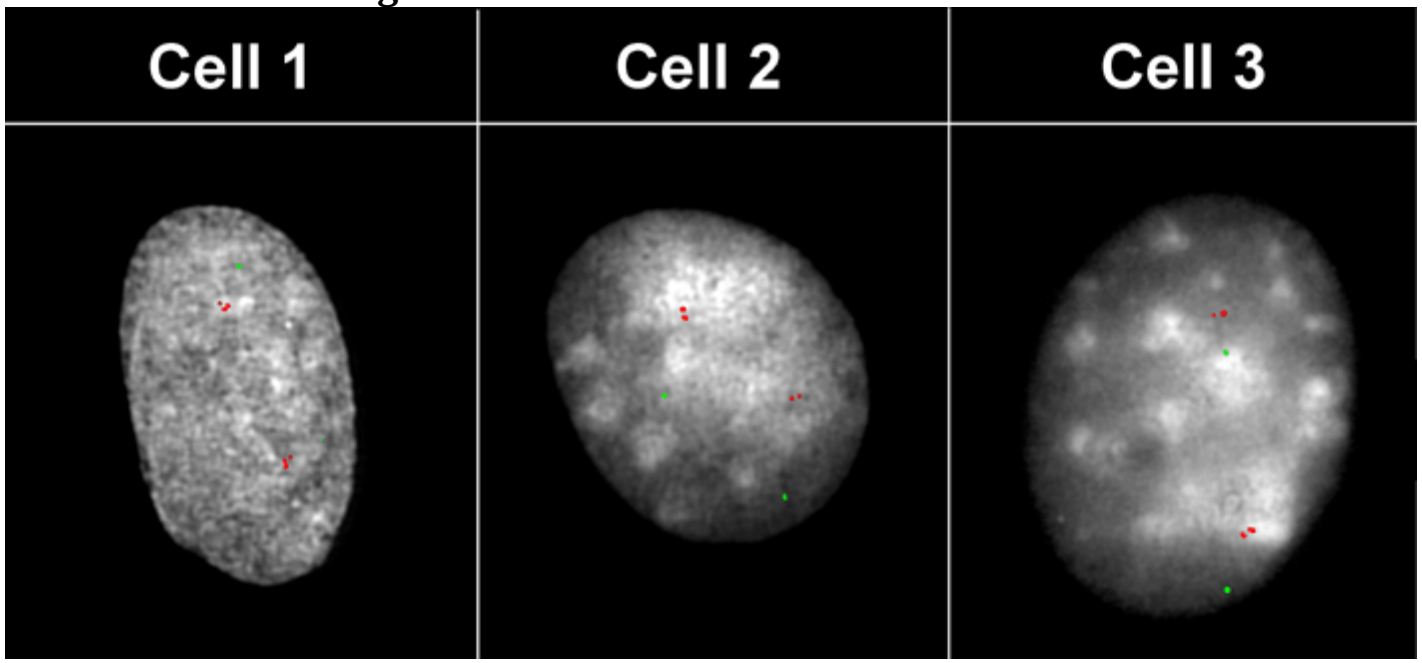
22. 503J20: No change



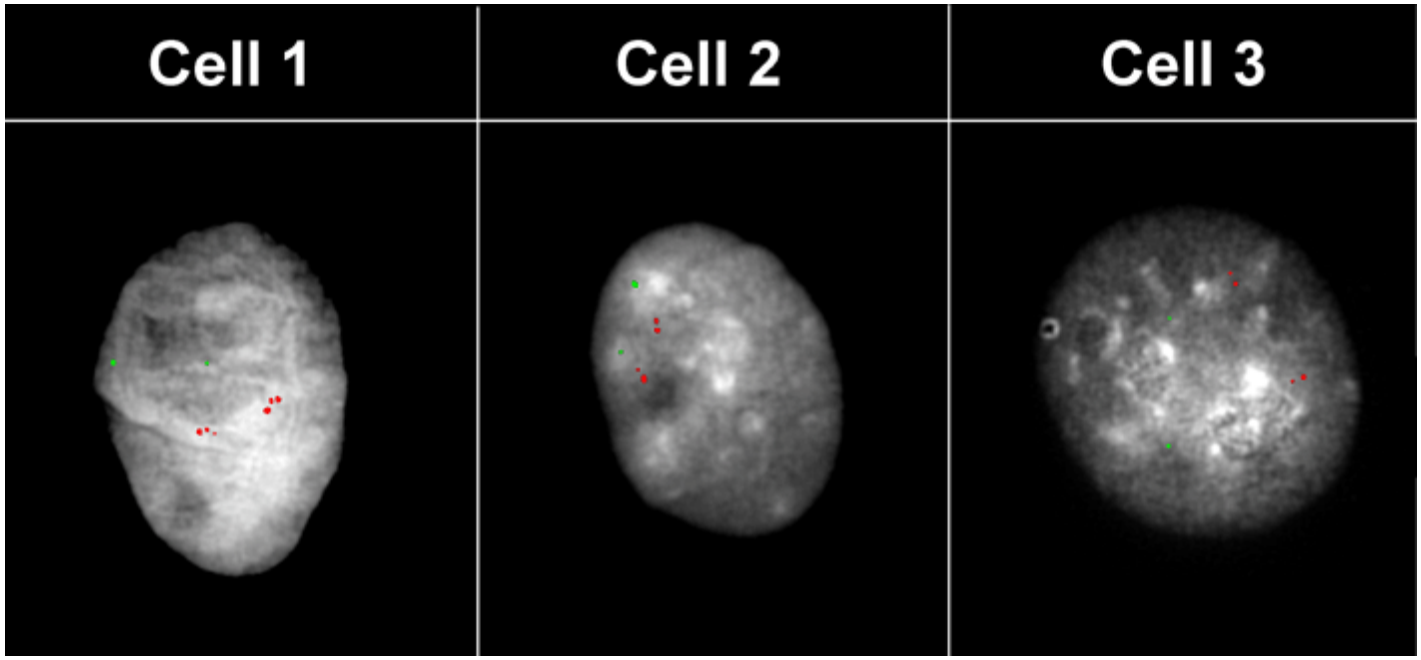
23. 501M13: No change



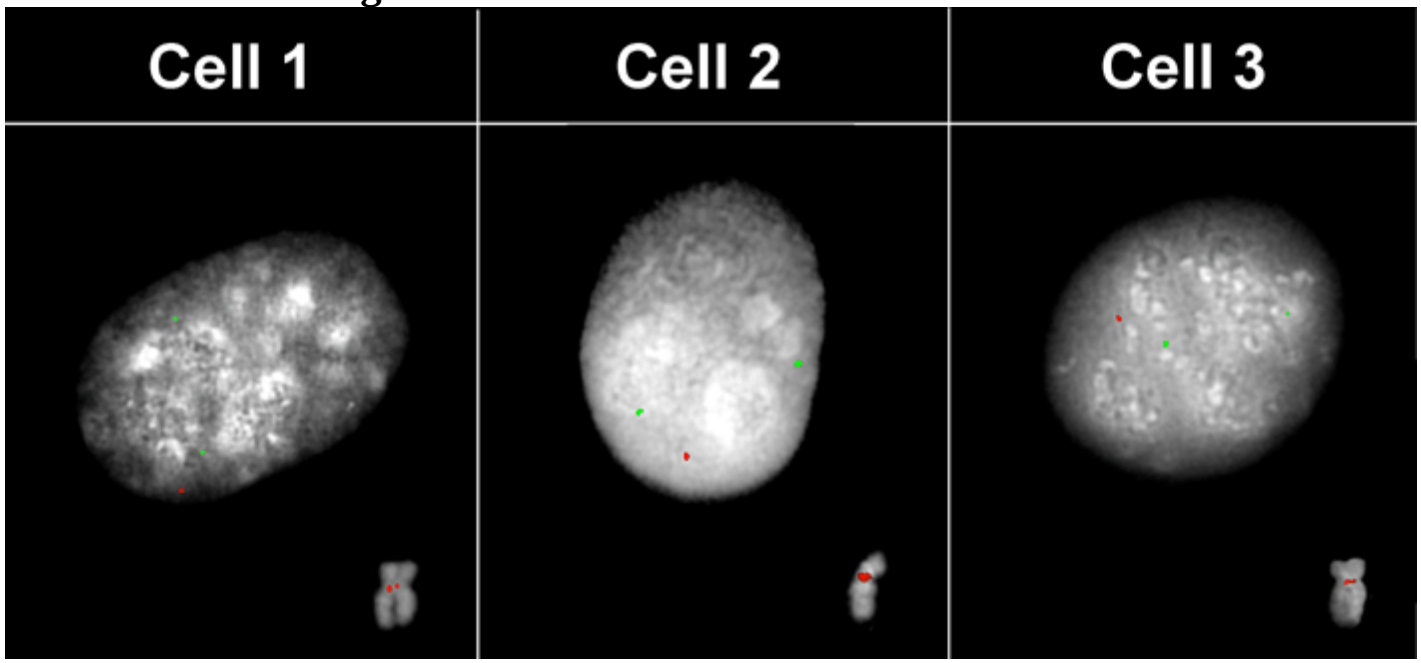
24. 175F18: No change



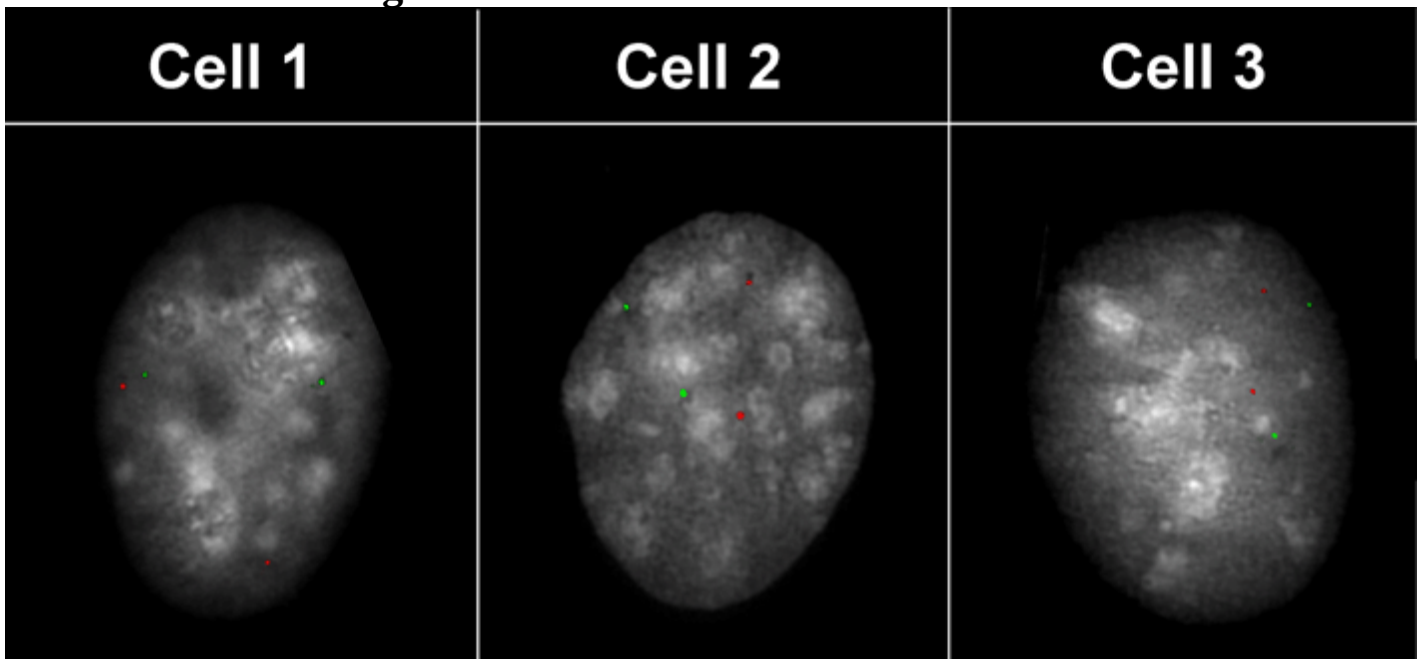
25. 2O12: Yes



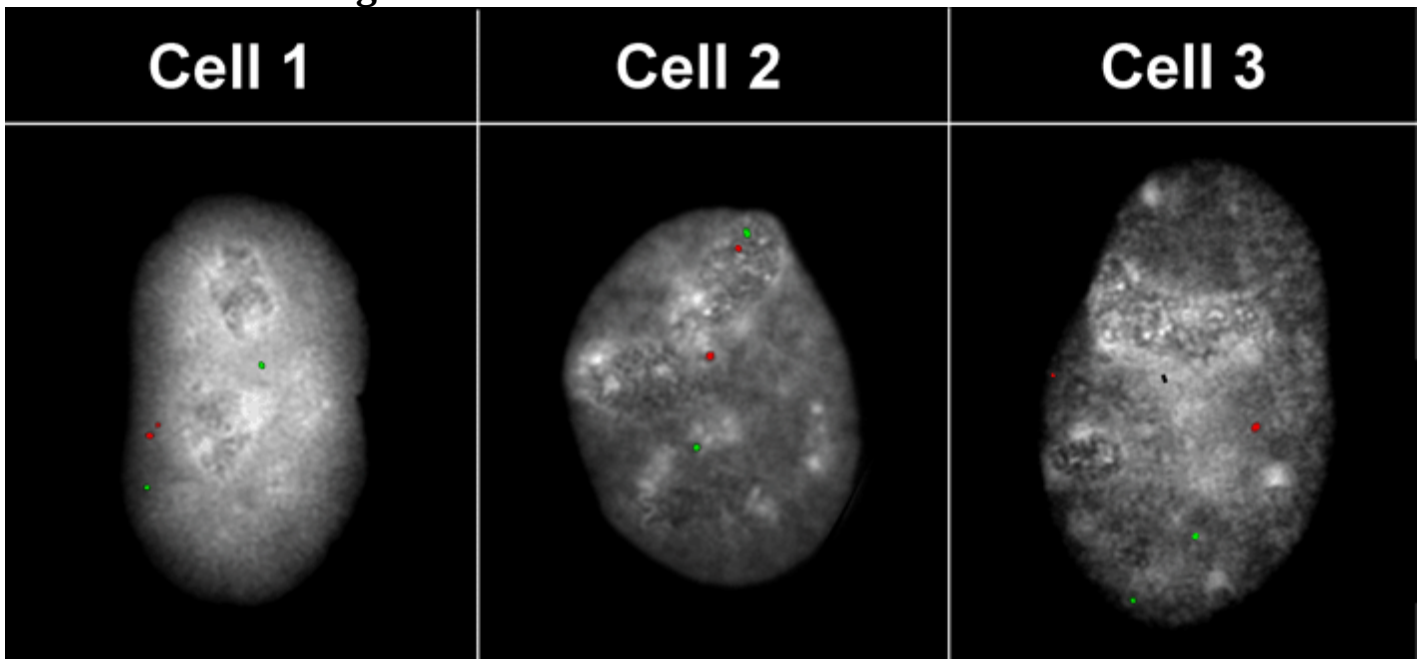
26. 138D7: No change



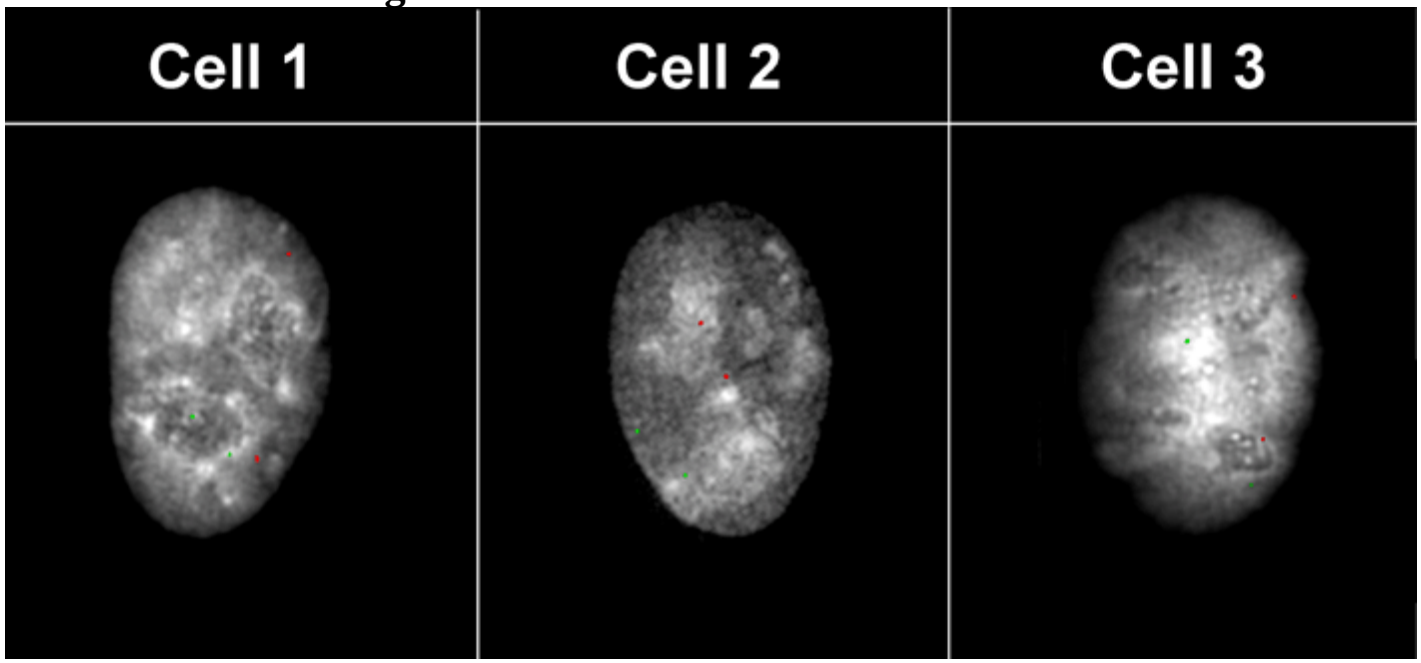
27. 132D11: No change



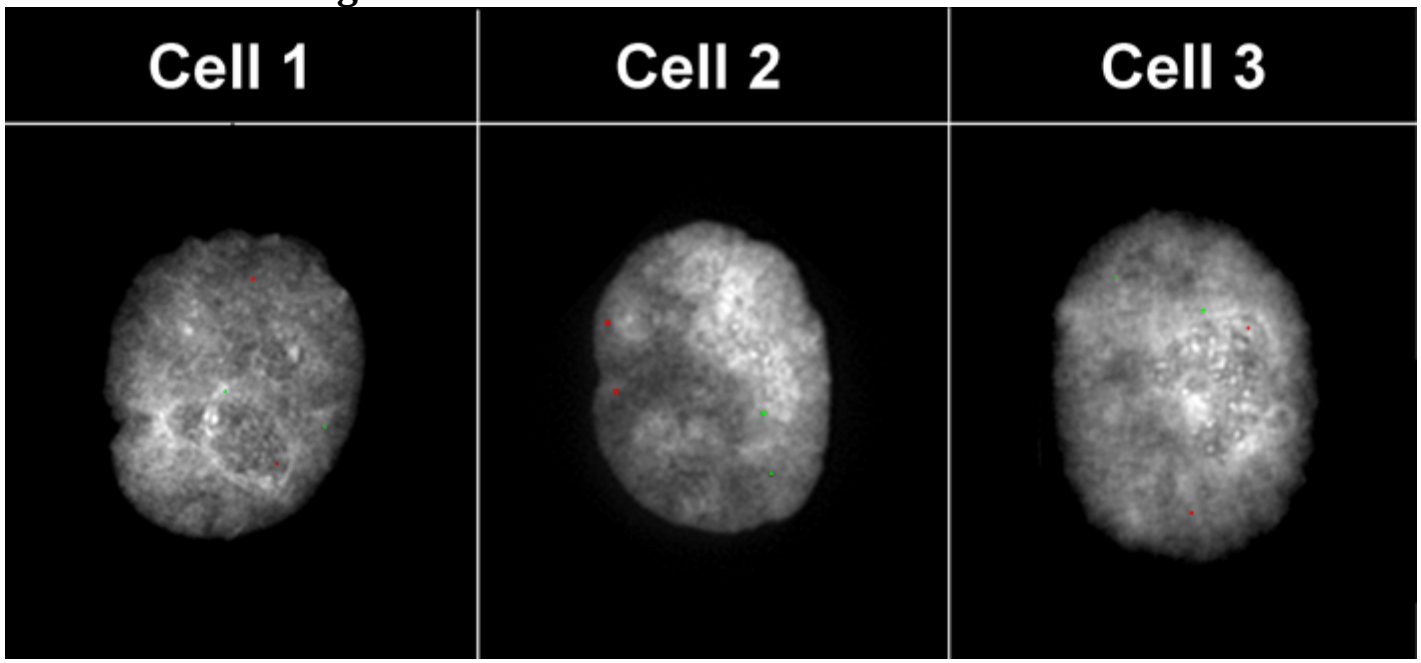
28. 73F10: No change



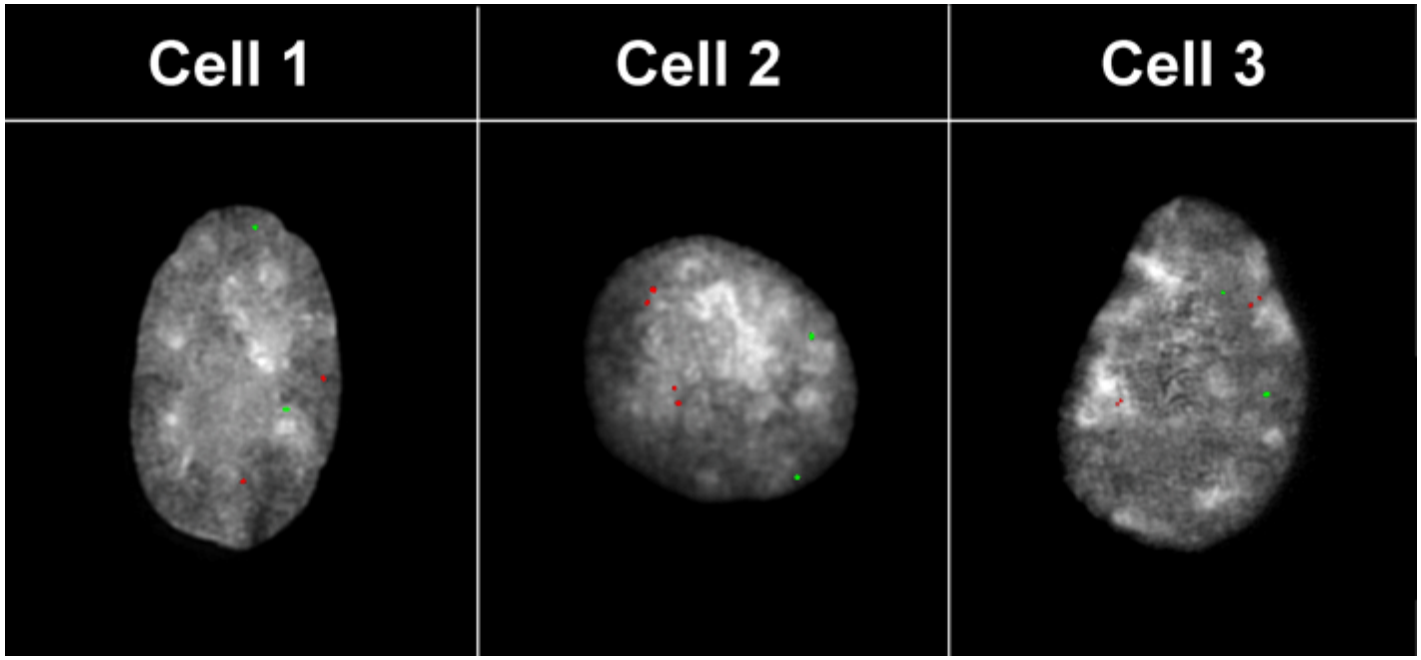
29. 240G20: No change



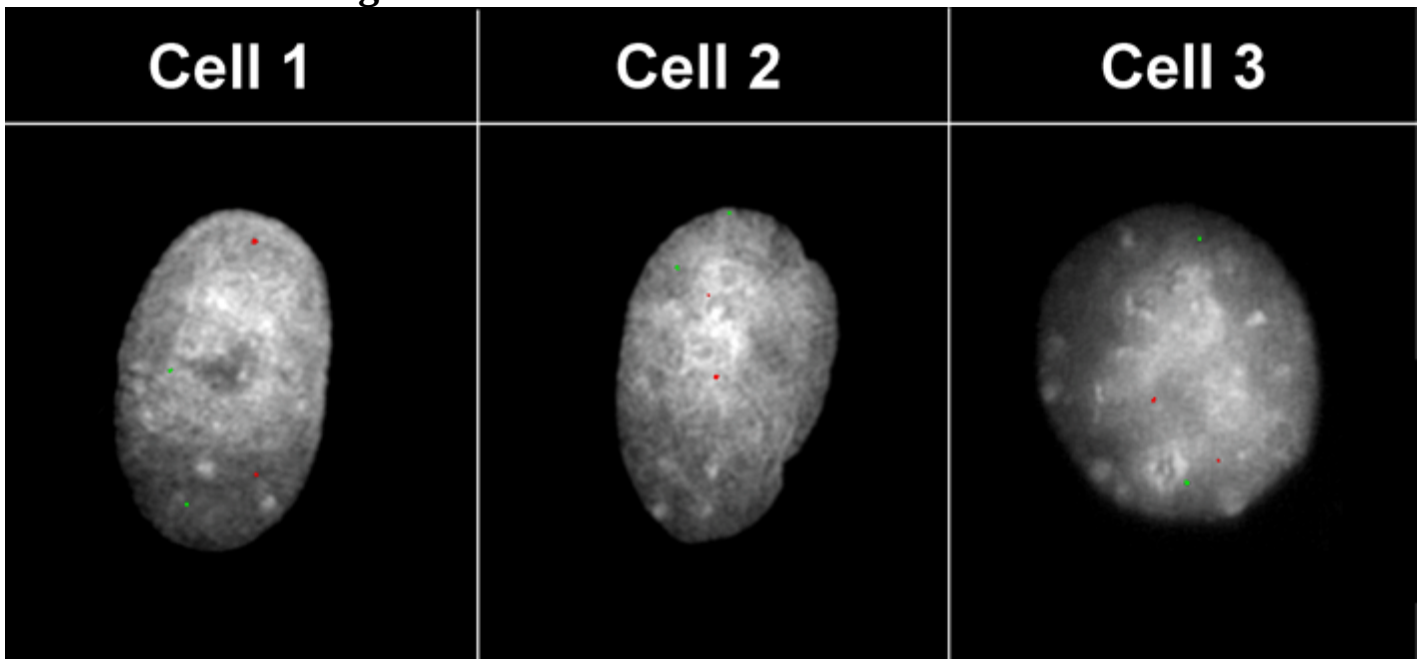
30. 81B5: No change



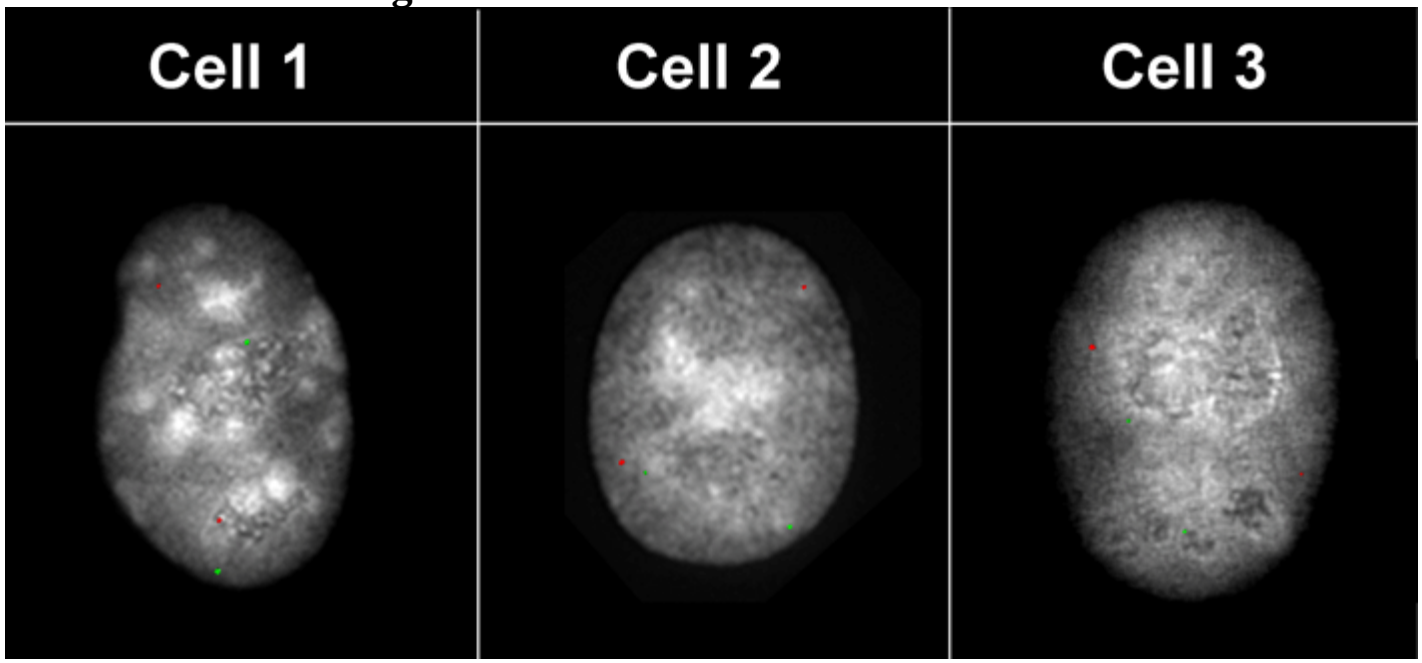
31. 446K15: Yes



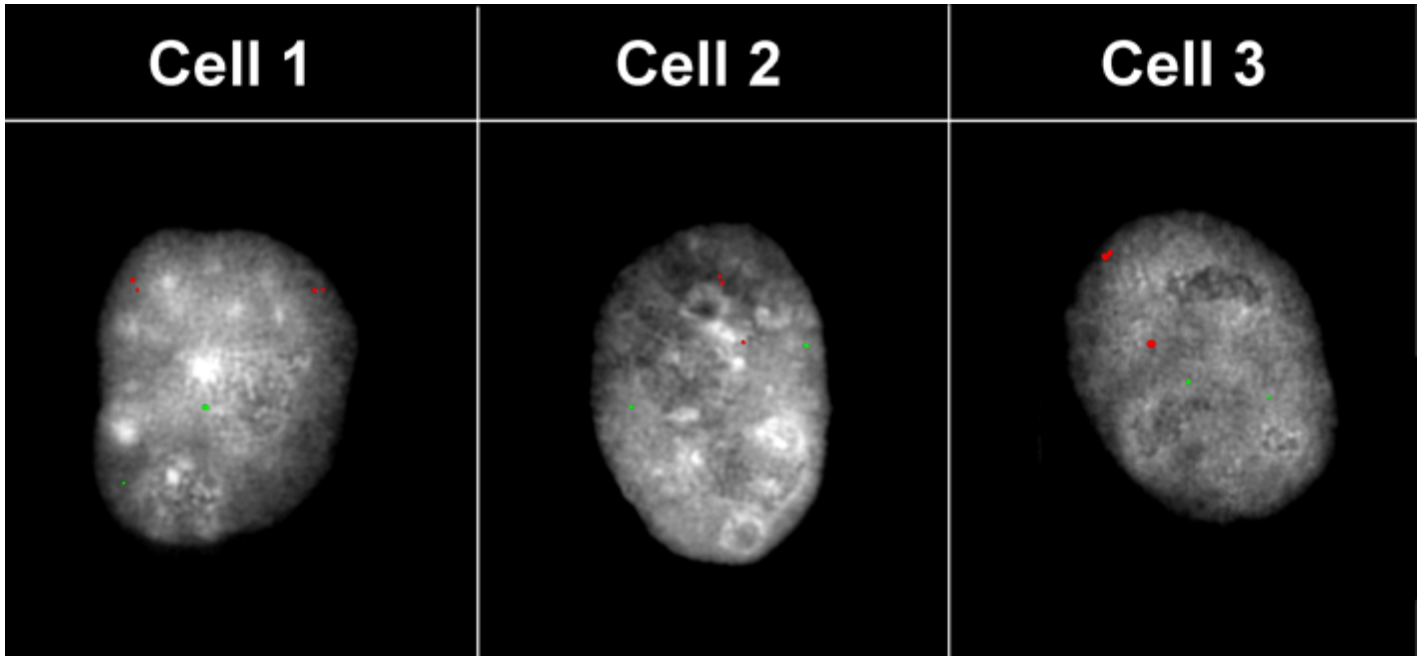
32. 126B8: No change



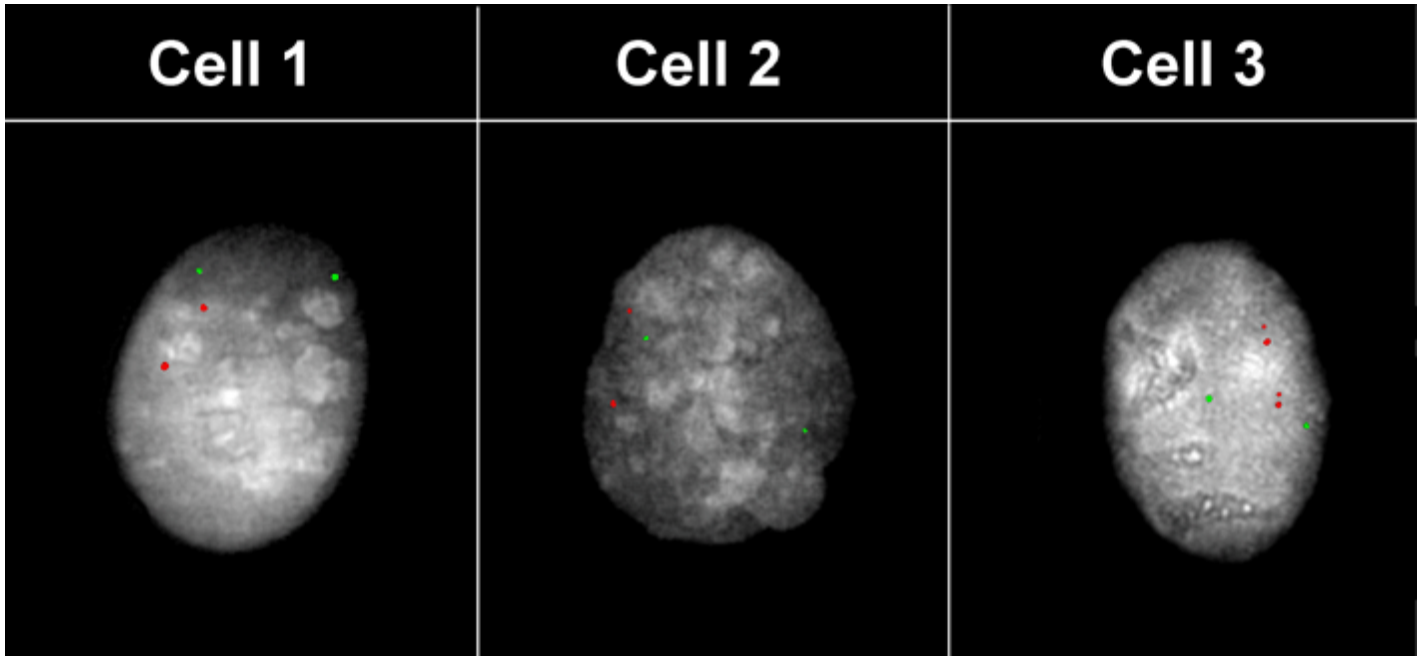
33. 429M18: No change



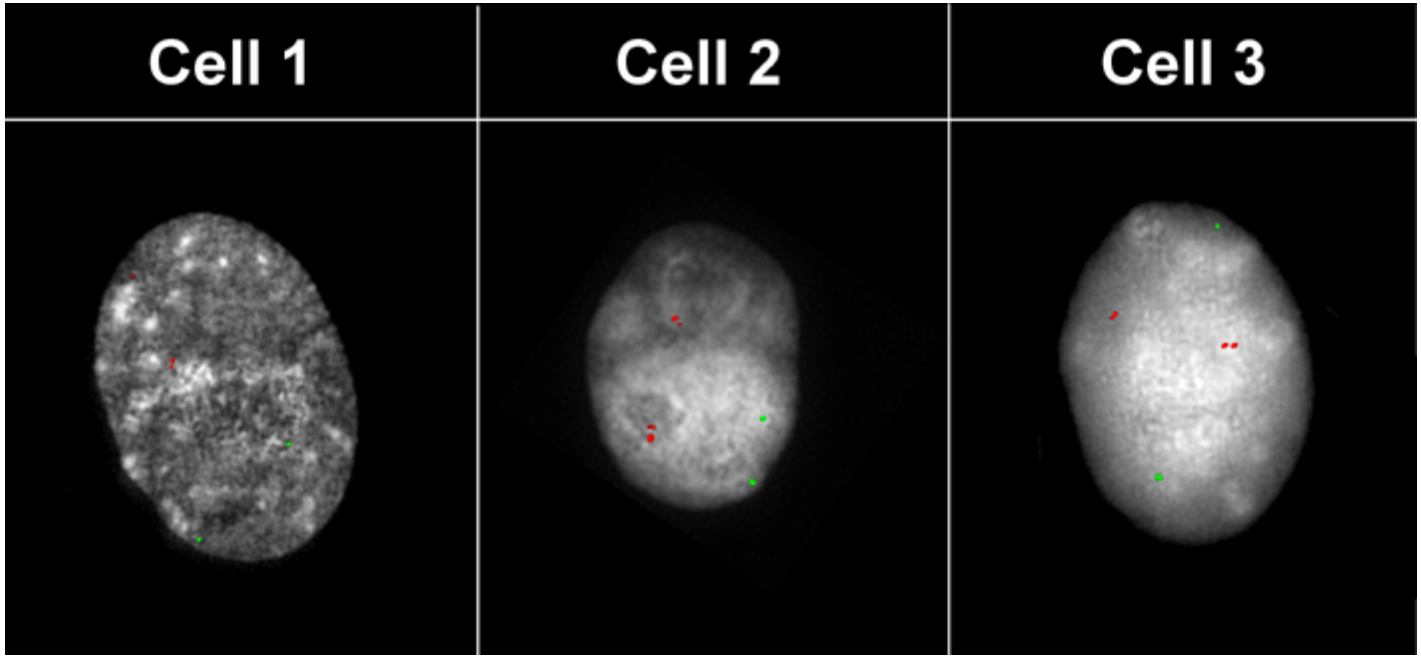
34. 498N9: Yes



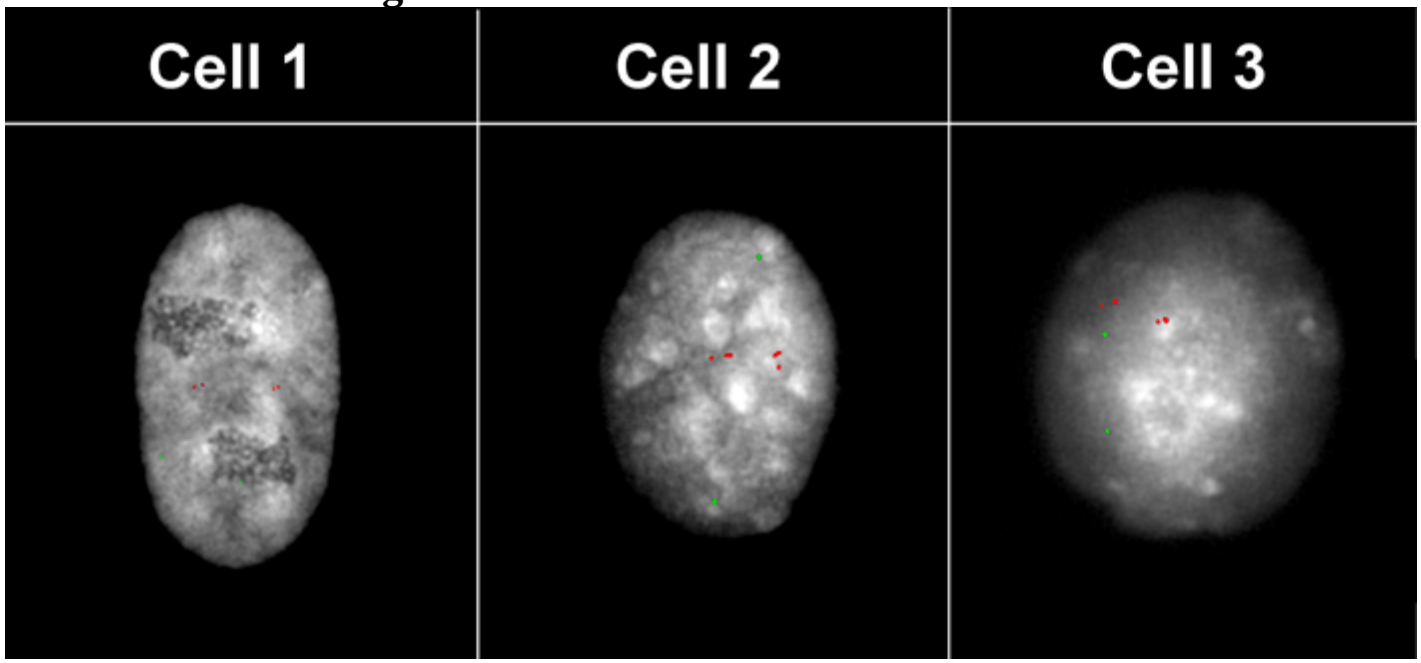
35. 263M20: Yes



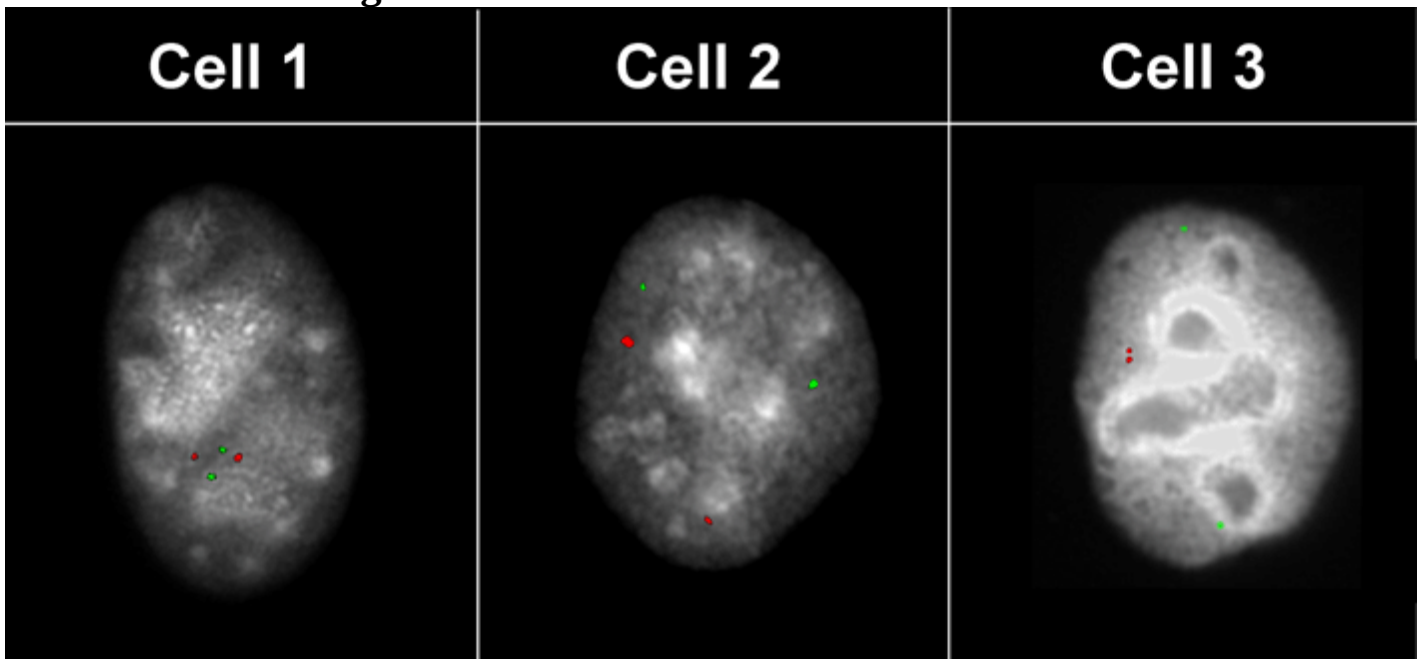
36. 392A13: Yes



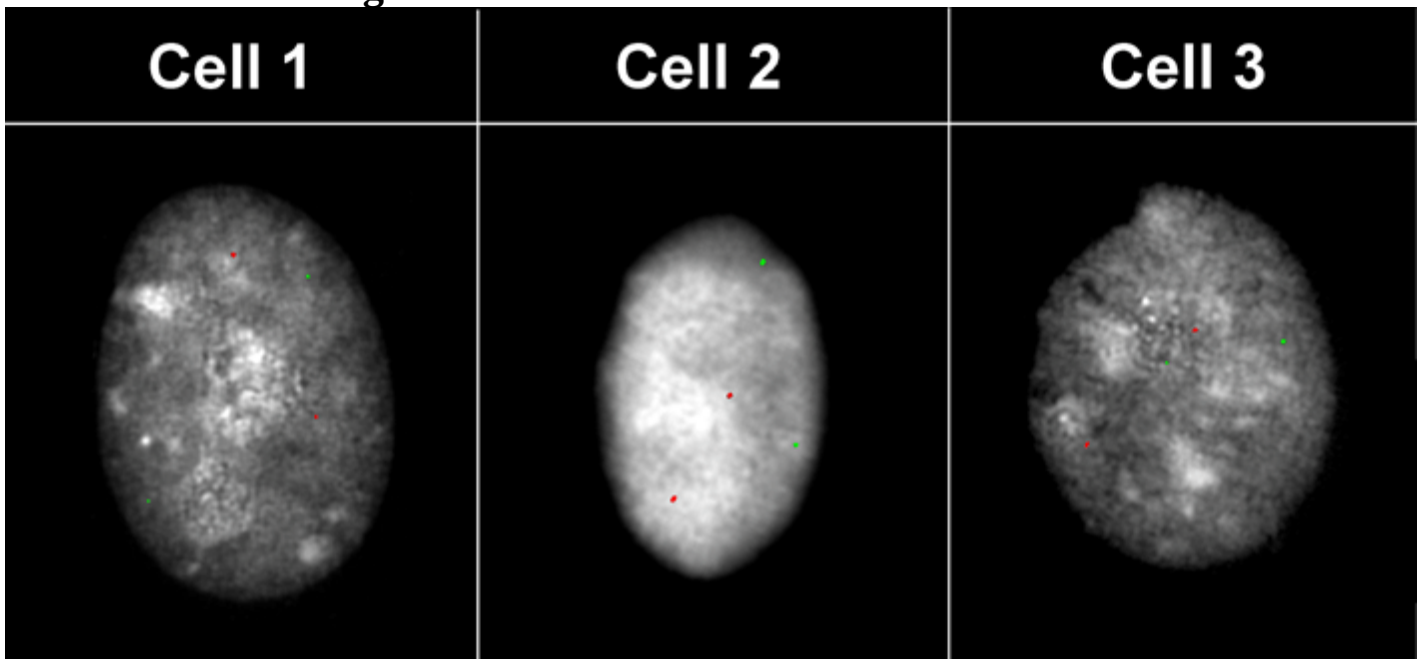
37. 126D18: No change



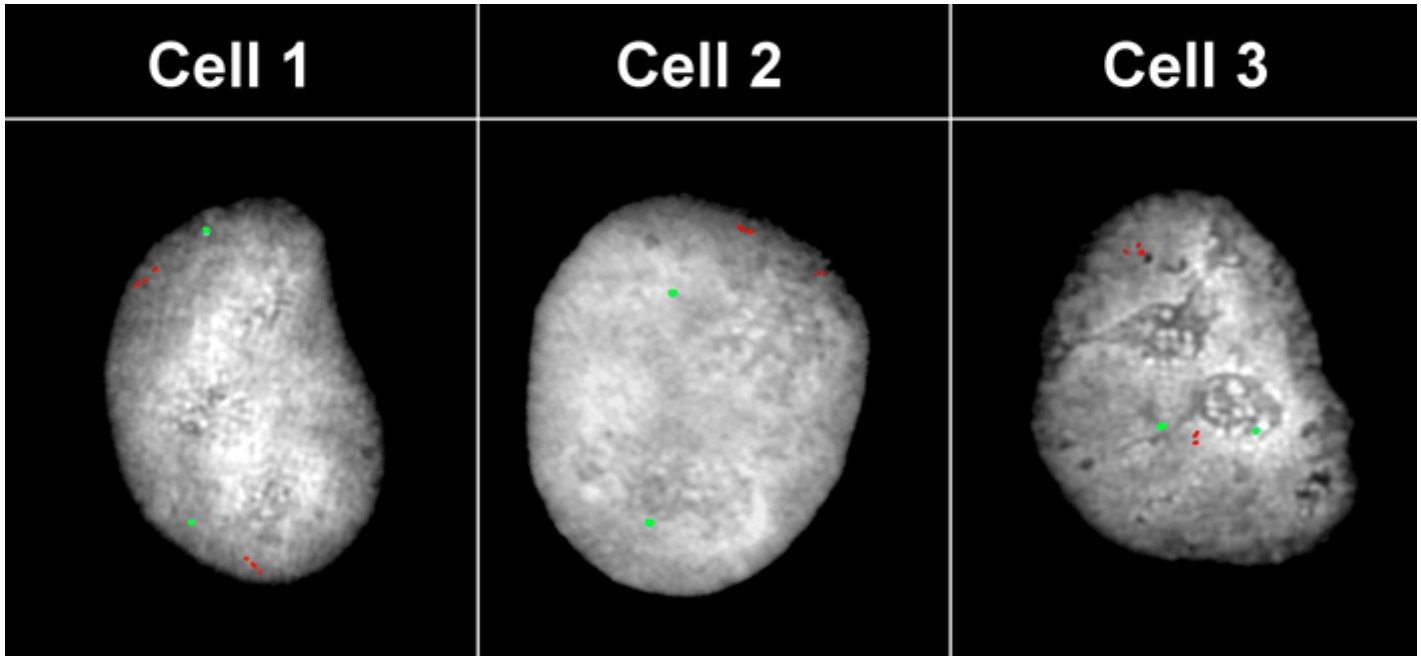
38. 63C13: No change



39. 223K8: No change



40. 338M16: Yes



41. 117G16: Yes