

Supplementary Material

Supplementary Table 1. Statistics of RNA-seq datasets and SAGs of 150 groups in SAGD.

sagd_id ¹	species	Project ²	tissue	stage	sample	sample_M _num ⁴	sag_F_ num ⁵	sag_M_ num ⁶	sex chromosome ⁷	XorZ _F ⁸	XorZ _M ⁹	percent_Xo rZ_F ¹⁰	percent_Xo rZ_M ¹¹
					_F_nu m ³								
SAGD_00139	Bos taurus	SRP052656	fat	adult	5	5	10	8	XY	0	6	0.0	75.0
SAGD_00140	Bos taurus	SRP052656	liver	adult	5	5	12	11	XY	0	6	0.0	54.5
SAGD_00141	Bos taurus	SRP052656	muscle	adult	5	4	18	14	XY	1	6	5.6	42.9
SAGD_00142	Bos taurus	SRP052656	pituitary gland	adult	5	5	7	27	XY	0	7	0.0	25.9
SAGD_00099	Caenorhabditis brenneri	SRP016006	whole body	adult	3	3	3583	5465	NA	NA	NA	NA	NA
SAGD_00110	Caenorhabditis elegans	SRP034667	whole body	adult	4	4	1227	3345	XY	275	228	22.4	6.8
SAGD_00156	Caenorhabditis elegans	SRP062096	gonadal precursors	larva	5	5	21	89	XY	4	18	19.0	20.2
SAGD_00157	Caenorhabditis elegans	SRP062096	whole body	larva	5	5	3	2	XY	1	0	33.3	0.0
SAGD_00100	Caenorhabditis japonica	SRP016006	whole body	adult	3	3	1855	3384	NA	NA	NA	NA	NA
SAGD_00101	Caenorhabditis remanei	SRP016006	whole body	adult	3	3	2799	4485	NA	NA	NA	NA	NA
SAGD_00136	Danio rerio	SRP046222	brain	adult	2	2	3	14	NA	NA	NA	NA	NA
SAGD_00023	Drosophila ananassae	SRP006203	whole body	adult	2	2	295	2406	NA	NA	NA	NA	NA
SAGD_00134	Drosophila melanogaster	SRP045429	whole body	adult	10	10	1000	5046	XY	252	575	25.2	11.4
SAGD_00161	Drosophila melanogaster	SRP069203	Adult whole organisms without gonad	adult	20	20	196	1725	XY	46	190	23.5	11.0
SAGD_00183	Drosophila melanogaster	SRP108530	abdomen without digestive or reproductive system	adult	6	6	191	131	XY	37	19	19.4	14.5
SAGD_00184	Drosophila melanogaster	SRP108530	digestive plus excretory system	adult	8	8	50	59	XY	13	13	26.0	22.0
SAGD_00185	Drosophila melanogaster	SRP108530	genitalia	adult	8	8	270	563	XY	48	74	17.8	13.1

SAGD_00186	<i>Drosophila melanogaster</i>	SRP108530	gonad	adult	8	8	1397	5987	XY	383	711	27.4	11.9
SAGD_00187	<i>Drosophila melanogaster</i>	SRP108530	head	adult	8	8	53	36	XY	10	20	18.9	55.6
SAGD_00188	<i>Drosophila melanogaster</i>	SRP108530	reproductive system without gonad and genitalia	adult	6	6	952	1216	XY	140	102	14.7	8.4
SAGD_00189	<i>Drosophila melanogaster</i>	SRP108530	thorax without digestive system	adult	6	6	86	41	XY	17	12	19.8	29.3
SAGD_00024	<i>Drosophila mojavensis</i>	SRP006203	whole body	adult	2	2	1000	2433	NA	NA	NA	NA	NA
SAGD_00022	<i>Drosophila pseudoobscura</i>	SRP006203	whole body	adult	2	2	1124	3078	XY	501	885	44.6	28.8
SAGD_00028	<i>Drosophila pseudoobscura</i>	SRP007818	Carcass minus reproductive tract	adult	2	2	175	2288	XY	83	671	47.4	29.3
SAGD_00029	<i>Drosophila pseudoobscura</i>	SRP007818	Dissected Gonad and Reproductive Tract	adult	2	2	2567	5731	XY	1150	1554	44.8	27.1
SAGD_00025	<i>Drosophila simulans</i>	SRP006203	whole body	adult	4	3	861	2734	XY	182	365	21.1	13.4
SAGD_00030	<i>Drosophila simulans</i>	SRP007818	Carcass minus reproductive tract	adult	2	2	190	1566	XY	34	182	17.9	11.6
SAGD_00026	<i>Drosophila virilis</i>	SRP006203	whole body	adult	2	2	416	2370	NA	NA	NA	NA	NA
SAGD_00027	<i>Drosophila yakuba</i>	SRP006203	whole body	adult	2	2	594	2526	XY	120	314	20.2	12.4
SAGD_00078	<i>Equus caballus</i>	SRP012972	blood	adult	4	8	9	19	XY	1	0	11.1	0.0
SAGD_00079	<i>Equus caballus</i>	SRP012972	muscle	adult	4	8	1	2	XY	0	0	0.0	0.0
SAGD_00005	<i>Gallus gallus</i>	ERP009469	brain	embryo	5	5	627	91	ZW	19	12	3.0	13.2
SAGD_00006	<i>Gallus gallus</i>	ERP009469	bursa	embryo	5	5	106	25	ZW	5	1	4.7	4.0
SAGD_00007	<i>Gallus gallus</i>	ERP009469	gonad	embryo	5	5	1882	331	ZW	51	44	2.7	13.3
SAGD_00008	<i>Gallus gallus</i>	ERP009469	heart	embryo	5	5	106	2	ZW	4	0	3.8	0.0
SAGD_00009	<i>Gallus gallus</i>	ERP009469	kidney	embryo	5	5	75	7	ZW	2	0	2.7	0.0
SAGD_00010	<i>Gallus gallus</i>	ERP009469	liver	embryo	4	4	64	9	ZW	4	1	6.3	11.1
SAGD_00011	<i>Gallus gallus</i>	ERP009469	lung	embryo	5	5	69	8	ZW	2	0	2.9	0.0

SAGD_00012	Gallus gallus	ERP009469	muscle	embryo	5	5	73	16	ZW	3	2	4.1	12.5
SAGD_00013	Gallus gallus	ERP009469	spleen	embryo	4	5	47	8	ZW	1	1	2.1	12.5
SAGD_00001	Homo sapiens	ERP006650	skeletal muscle	adult	3	2	20	26	XY	1	0	5.0	0.0
SAGD_00002	Homo sapiens	ERP007111	skin	adult	10	10	8	15	XY	1	0	12.5	0.0
SAGD_00014	Homo sapiens	SRP001371	adrenal gland	fetus	2	2	8	25	XY	1	1	12.5	4.0
SAGD_00015	Homo sapiens	SRP001371	large intestine	fetus	3	3	13	26	XY	1	0	7.7	0.0
SAGD_00016	Homo sapiens	SRP001371	small intestine	fetus	3	3	3	24	XY	2	0	66.7	0.0
SAGD_00019	Homo sapiens	SRP001558	liver	adult	6	6	54	30	XY	3	0	5.6	0.0
SAGD_00032	Homo sapiens	SRP012682	adrenal gland	unknown	16	20	15	43	XY	2	0	13.3	0.0
SAGD_00033	Homo sapiens	SRP012682	amygdala	unknown	8	12	9	39	XY	2	0	22.2	0.0
SAGD_00034	Homo sapiens	SRP012682	aorta	unknown	18	20	2	37	XY	2	0	100.0	0.0
SAGD_00035	Homo sapiens	SRP012682	atrium auricular region	unknown	17	20	30	49	XY	3	0	10.0	0.0
SAGD_00036	Homo sapiens	SRP012682	blood	unknown	16	19	10	18	XY	1	0	10.0	0.0
SAGD_00037	Homo sapiens	SRP012682	breast	unknown	15	20	396	143	XY	9	7	2.3	4.9
SAGD_00038	Homo sapiens	SRP012682	Brodman (1909) area 24	unknown	18	20	13	33	XY	3	1	23.1	3.0
SAGD_00039	Homo sapiens	SRP012682	Brodman (1909) area 9	unknown	16	19	28	37	XY	3	0	10.7	0.0
SAGD_00040	Homo sapiens	SRP012682	C1 segment of cervical spinal cord	unknown	17	18	5	37	XY	2	0	40.0	0.0
SAGD_00041	Homo sapiens	SRP012682	caudate nucleus	unknown	13	20	2	38	XY	2	0	100.0	0.0
SAGD_00042	Homo sapiens	SRP012682	cerebellar hemisphere	unknown	13	20	72	41	XY	4	0	5.6	0.0
SAGD_00043	Homo sapiens	SRP012682	cerebellum	unknown	13	20	1	22	XY	1	0	100.0	0.0
SAGD_00044	Homo sapiens	SRP012682	cerebral cortex	unknown	12	20	5	36	XY	2	0	40.0	0.0
SAGD_00045	Homo sapiens	SRP012682	coronary artery	unknown	20	17	23	44	XY	3	0	13.0	0.0
SAGD_00046	Homo sapiens	SRP012682	cortex of kidney	unknown	8	20	22	35	XY	3	0	13.6	0.0
SAGD_00047	Homo sapiens	SRP012682	EBV-transformed lymphocyte	unknown	19	20	21	39	XY	3	0	14.3	0.0
SAGD_00048	Homo sapiens	SRP012682	esophagogastric junction	unknown	14	20	9	39	XY	2	0	22.2	0.0

SAGD_00049	Homo sapiens	SRP012682	esophagus mucosa	unknown	17	20	6	36	XY	2	0	33.3	0.0
SAGD_00050	Homo sapiens	SRP012682	esophagus muscularis mucosa	unknown	16	20	4	33	XY	3	0	75.0	0.0
SAGD_00051	Homo sapiens	SRP012682	gonad	unknown	20	17	2483	15864	XY	203	414	8.2	2.6
SAGD_00052	Homo sapiens	SRP012682	greater omentum	unknown	18	19	27	34	XY	3	0	11.1	0.0
SAGD_00053	Homo sapiens	SRP012682	heart left ventricle	unknown	12	20	5	30	XY	3	0	60.0	0.0
SAGD_00054	Homo sapiens	SRP012682	hippocampus proper	unknown	14	20	11	35	XY	4	0	36.4	0.0
SAGD_00055	Homo sapiens	SRP012682	hypothalamus	unknown	17	20	3	42	XY	2	0	66.7	0.0
SAGD_00056	Homo sapiens	SRP012682	liver	unknown	18	20	16	36	XY	2	0	12.5	0.0
SAGD_00057	Homo sapiens	SRP012682	lower leg skin	unknown	14	20	4	44	XY	2	1	50.0	2.3
SAGD_00058	Homo sapiens	SRP012682	lung	unknown	17	19	9	33	XY	3	0	33.3	0.0
SAGD_00059	Homo sapiens	SRP012682	minor salivary gland	unknown	6	14	5	33	XY	2	0	40.0	0.0
SAGD_00060	Homo sapiens	SRP012682	nucleus accumbens	unknown	17	20	5	39	XY	3	0	60.0	0.0
SAGD_00061	Homo sapiens	SRP012682	pancreas	unknown	17	20	3	31	XY	3	0	100.0	0.0
SAGD_00062	Homo sapiens	SRP012682	pituitary gland	unknown	20	15	8	45	XY	2	1	25.0	2.2
SAGD_00063	Homo sapiens	SRP012682	putamen	unknown	14	20	10	37	XY	2	1	20.0	2.7
SAGD_00064	Homo sapiens	SRP012682	sigmoid colon	unknown	18	20	320	52	XY	5	0	1.6	0.0
SAGD_00065	Homo sapiens	SRP012682	skeletal muscle tissue	unknown	15	20	2	35	XY	2	0	100.0	0.0
SAGD_00066	Homo sapiens	SRP012682	small intestine Peyer's patch	unknown	16	20	17	91	XY	2	3	11.8	3.3
SAGD_00067	Homo sapiens	SRP012682	spleen	unknown	17	18	5	32	XY	4	0	80.0	0.0
SAGD_00068	Homo sapiens	SRP012682	stomach	unknown	20	17	2	33	XY	2	0	100.0	0.0
SAGD_00069	Homo sapiens	SRP012682	subcutaneous adipose tissue	unknown	16	20	19	114	XY	4	2	21.1	1.8
SAGD_00070	Homo sapiens	SRP012682	substantia nigra	unknown	9	11	9	31	XY	2	1	22.2	3.2
SAGD_00071	Homo sapiens	SRP012682	suprapubic skin	unknown	16	20	8	100	XY	2	0	25.0	0.0
SAGD_00072	Homo sapiens	SRP012682	thyroid gland	unknown	17	19	13	35	XY	4	0	30.8	0.0
SAGD_00073	Homo sapiens	SRP012682	tibial artery	unknown	14	20	3	49	XY	2	0	66.7	0.0

SAGD_00074	Homo sapiens	SRP012682	tibial nerve	unknown	19	20	3	35	XY	2	0	66.7	0.0
SAGD_00075	Homo sapiens	SRP012682	transformed skin fibroblast	unknown	15	20	5	30	XY	2	0	40.0	0.0
SAGD_00076	Homo sapiens	SRP012682	transverse colon	unknown	18	19	5	34	XY	2	0	40.0	0.0
SAGD_00077	Homo sapiens	SRP012682	urinary bladder	unknown	5	5	18	27	XY	2	0	11.1	0.0
SAGD_00106	Homo sapiens	SRP021917	colon	unknown	3	2	14	48	XY	2	2	14.3	4.2
SAGD_00107	Homo sapiens	SRP022133	whole blood	adult	3	17	43	83	XY	0	2	0.0	2.4
SAGD_00108	Homo sapiens	SRP027364	thyroid gland tumor	adult	2	2	11	60	XY	1	2	9.1	3.3
SAGD_00129	Homo sapiens	SRP038863	long bone	child	2	2	1159	1122	XY	38	25	3.3	2.2
SAGD_00130	Homo sapiens	SRP038863	skull	child	1	3	19	12	XY	0	0	0.0	0.0
SAGD_00131	Homo sapiens	SRP043221	muscle	unknown	6	13	10	33	XY	3	0	30.0	0.0
SAGD_00132	Homo sapiens	SRP043221	myoblast	unknown	4	2	374	304	XY	11	5	2.9	1.6
SAGD_00133	Homo sapiens	SRP043221	myotube	unknown	5	3	13	45	XY	1	3	7.7	6.7
SAGD_00135	Homo sapiens	SRP045666	skeletal muscle	unknown	16	17	7	24	XY	1	0	14.3	0.0
SAGD_00137	Homo sapiens	SRP046233	bone marrow	adult	5	9	1	6	XY	1	0	100.0	0.0
SAGD_00138	Homo sapiens	SRP050146	bone marrow	unknown	2	2	56	126	XY	1	1	1.8	0.8
SAGD_00153	Homo sapiens	SRP056604	hippocampus	adult	2	2	8	14	XY	0	0	0.0	0.0
SAGD_00158	Homo sapiens	SRP066197	blood	adult	10	10	3	23	XY	3	0	100.0	0.0
SAGD_00163	Homo sapiens	SRP074349	lung	adult	19	20	84	260	XY	5	5	6.0	1.9
SAGD_00017	Macaca mulatta	SRP001558	liver	adult	6	6	26	131	XY	1	2	3.8	1.5
SAGD_00003	Mus musculus	ERP008773	embryo	fetus	20	20	1	5	XY	1	0	100.0	0.0
SAGD_00004	Mus musculus	ERP008773	whole body	fetus	20	20	1	2	XY	1	0	100.0	0.0
SAGD_00020	Mus musculus	SRP002811	medial prefrontal cortex	child	4	4	1	5	XY	1	0	100.0	0.0
SAGD_00021	Mus musculus	SRP002811	preoptic area	child	4	4	1	1	XY	1	0	100.0	0.0
SAGD_00105	Mus musculus	SRP020636	liver	adult	20	20	144	169	XY	5	3	3.5	1.8
SAGD_00143	Mus musculus	SRP053401	brainstem	adult	4	4	2	5	XY	1	0	50.0	0.0
SAGD_00144	Mus musculus	SRP053401	brown adipose tissue	adult	4	4	24	17	XY	1	0	4.2	0.0

SAGD_00145	Mus musculus	SRP053401	cerebellum	adult	4	4	2	5	XY	1	0	50.0	0.0
SAGD_00146	Mus musculus	SRP053401	corpus callosum	adult	4	4	1	6	XY	1	0	100.0	0.0
SAGD_00147	Mus musculus	SRP053401	gastrocnemius	adult	4	4	91	56	XY	3	2	3.3	3.6
SAGD_00148	Mus musculus	SRP053401	heart	adult	4	4	1	7	XY	1	0	100.0	0.0
SAGD_00149	Mus musculus	SRP053401	hypothalamus and thalamus	adult	4	4	1	5	XY	1	0	100.0	0.0
SAGD_00150	Mus musculus	SRP053401	skin	adult	3	3	51	516	XY	3	4	5.9	0.8
SAGD_00151	Mus musculus	SRP053401	white adipose tissue around gonad	adult	3	4	267	227	XY	7	10	2.6	4.4
SAGD_00152	Mus musculus	SRP053401	white adipose tissue around intestine	adult	4	4	7	17	XY	1	2	14.3	11.8
SAGD_00155	Mus musculus	SRP060293	hypothalamus	adult	6	3	1	2	XY	0	0	0.0	0.0
SAGD_00160	Mus musculus	SRP068123	hippocampus	adult	18	18	1	7	XY	1	0	100.0	0.0
SAGD_00180	Mus musculus	SRP102060	parotid gland	adult	3	3	1	7	XY	1	0	100.0	0.0
SAGD_00181	Mus musculus	SRP102060	sublingual gland	adult	3	3	6	4	XY	1	0	16.7	0.0
SAGD_00182	Mus musculus	SRP102060	submandibular gland	adult	3	3	57	162	XY	2	0	3.5	0.0
SAGD_00018	Pan troglodytes	SRP001558	liver	adult	6	6	68	125	XY	2	1	2.9	0.8
SAGD_00109	Pristionchus pacificus	SRP034667	whole body	adult	3	3	973	1898	NA	NA	NA	NA	NA
SAGD_00111	Rattus norvegicus	SRP037986	adrenal gland	adult	12	12	26	25	XY	4	2	15.4	8.0
SAGD_00112	Rattus norvegicus	SRP037986	adrenal gland	child	4	4	12	13	XY	3	1	25.0	7.7
SAGD_00113	Rattus norvegicus	SRP037986	brain	adult	12	12	4	8	XY	3	0	75.0	0.0
SAGD_00114	Rattus norvegicus	SRP037986	brain	child	4	4	3	6	XY	3	0	100.0	0.0
SAGD_00115	Rattus norvegicus	SRP037986	gastrocnemius	adult	12	12	3	97	XY	3	2	100.0	2.1
SAGD_00116	Rattus norvegicus	SRP037986	gastrocnemius	child	4	4	7	90	XY	3	3	42.9	3.3
SAGD_00117	Rattus norvegicus	SRP037986	heart	adult	12	12	3	10	XY	3	0	100.0	0.0
SAGD_00118	Rattus norvegicus	SRP037986	heart	child	4	4	16	12	XY	3	0	18.8	0.0
SAGD_00119	Rattus norvegicus	SRP037986	kidney	adult	12	12	19	44	XY	3	4	15.8	9.1

SAGD_00120	Rattus norvegicus	SRP037986	kidney	child	4	4	6	9	XY	3	0	50.0	0.0
SAGD_00121	Rattus norvegicus	SRP037986	liver	adult	12	12	43	90	XY	4	2	9.3	2.2
SAGD_00122	Rattus norvegicus	SRP037986	liver	child	4	4	32	21	XY	4	1	12.5	4.8
SAGD_00123	Rattus norvegicus	SRP037986	lung	adult	12	12	3	12	XY	3	0	100.0	0.0
SAGD_00124	Rattus norvegicus	SRP037986	lung	child	4	4	32	18	XY	3	0	9.4	0.0
SAGD_00125	Rattus norvegicus	SRP037986	spleen	adult	12	12	3	12	XY	3	0	100.0	0.0
SAGD_00126	Rattus norvegicus	SRP037986	spleen	child	4	4	9	34	XY	3	1	33.3	2.9
SAGD_00127	Rattus norvegicus	SRP037986	thymus	adult	12	12	16	21	XY	3	0	18.8	0.0
SAGD_00128	Rattus norvegicus	SRP037986	thymus	child	4	4	3	5	XY	3	0	100.0	0.0
SAGD_00179	Rattus norvegicus	SRP100621	ventricular myocytes	adult	5	6	21	47	XY	3	4	14.3	8.5
SAGD_00190	Rattus norvegicus	SRP110541	Extensor digitorum longus	adult	6	6	24	11	XY	0	5	0.0	45.5
SAGD_00191	Rattus norvegicus	SRP110541	Soleus	adult	6	6	12	23	XY	4	0	33.3	0.0

Notes:

¹ Identifier for SAGD;

² SRA project accession for the group;

³ Number of female samples in the group;

⁴ Number of male samples in the group;

⁵ Number of female-biased genes in the group;

⁶ Number of male-biased genes in the group;

⁷ Sex determination system in the species. NA: No sex chromosome can be identified in the reference genome;

⁸ Number of female-biased genes on the X or Z chromosome;

⁹ Number of male-biased genes on the X or Z chromosome;

¹⁰ Percentage of female-biased genes on the X or Z chromosome;

¹¹ Percentage of male-biased genes on the X or Z chromosome.

Supplementary Table 2. Sex bias comparison among somatic tissues of human adults.

tissue	SAG_num ¹	SAG_M_num ²	SAG_F_num ³	M_M_num ⁴	F_F_num ⁵	retained_num ⁶	retained% ⁷
skeletal muscle	46	26	20	12	1	13	28.3
skin	590	531	59	42	13	55	9.3
liver	903	556	347	41	18	59	6.5
whole blood	126	83	43	2	1	3	2.4
thyroid gland tumor	71	60	11	20	2	22	31.0
bone marrow	7	6	1	0	1	1	14.3
hippocampus	30	21	9	8	3	11	36.7
blood	54	42	12	19	2	21	38.9
lung	359	272	87	34	7	41	11.4

Notes:

¹ Number of SAGs, including male-biased genes and female-biased genes, in the tissues;

² Number of male-biased genes in the tissue;

³ Number of female-biased genes in the tissue;

⁴ Number of male-biased genes in the tissue with male-biased expression in at least one of the other tissues of human adults;

⁵ Number of female-biased genes in the tissue with female-biased expression in at least one of the other tissues of human adults;

⁶ Number of SAGs in the tissue with shared sex bias in at least one of the other tissues of human adults. It is the sum of M_M_num and F_F_num;

⁷ Percentage of SAGs in the tissue with shared sex bias in at least one of the other tissues of human adults.

Supplementary Table 3. Sex bias comparison between adult somatic tissues of human and other species.

Species	ortholog_num¹	SAG_M_num²	SAG_F_num³	M_M_num⁴	F_F_num⁵	retained_num⁶	retained%⁷
Chimpanzee	24285	1684	1916	45	20	65	1.8
Macaque	22054	1541	1755	19	8	27	0.8
Mouse	20157	1612	1849	195	123	318	9.2
Rat	19585	1565	1792	62	49	111	3.3
Cow	19749	1572	1786	14	9	23	0.7
Horse	18824	1545	1751	4	2	6	0.2
Chicken	15610	1287	1524	23	106	129	4.6

Notes:

¹ Number of human genes with orthologs in the species;

² Number of human male-biased genes with orthologs in the species;

³ Number of human female-biased genes with orthologs in the species;

⁴ Number of human male-biased genes with male-biased orthologs in the species;

⁵ Number of human female-biased genes with female-biased orthologs in the species;

⁶ Number of human SAGs with shared sex bias in the species. It is the sum of M_M_num and F_F_num;

⁷ Percentage of human SAGs with shared sex bias in the species [$100 \times \text{retained_number} / (\text{SAG_M_num} + \text{SAG_F_num})$].