Vedlegg 3: FHF901340

Undersøkelse av kobling til biologi assosiert med ferskvannsoppvandringsevne for ett kandidat-SNP sett for hver av populasjonsgruppene: AquaGen, SalmoBreed, Mowi og Rauma.

Utført av: Stig Omholt og Laila Berg.

Til eksemplifisering valgte vi å bruke SNP-settet som ble produsert av parametersettet **EW = 10, A1_max = 20 og AW = 15 for alle avlspopulasjonene (se rapport for detaljer).**

Antallet SNPer i de fire kandidatsettene fordelte seg slik: AquaGen: 18, SalmoBreed: 13, Mowi: 16, Rauma 13.

AquaGen: ['ctg7180001900376_8301_SAG', 'ctg7180001335371_3683_SAC', 'ctg7180001805519_4864_SAG', 'ctg7180001281527_848_SCT', 'ctg7180001891409_3634_SCT', 'ctg7180001797454_43093_SAG', 'ctg7180001857660_10743_SAG', 'ctg7180001870716_3401_SCT', 'ctg7180001793773_4907', 'ctg7180001912369_4971_SAG', 'ctg7180001679281_5789_SAC', 'ctg7180001885038_4967_SAC', 'ctg7180001906456_6568_SGT', 'ctg7180001398466_7983_SAG', 'ctg7180001916146_1772_SCT', 'ctg7180001845082_7172_SAG', 'ctg7180001835143_8201_SGT', 'ctg7180001845450_3014_SAC']

SalmoBreed: ['ctg7180001851039_10290_SAC', 'ctg7180001878854_3628_SAG', 'ctg7180001364094_5295_SCT', 'ctg7180001903360_761_SAC', 'ctg7180001591304_4622_SGT', 'ctg7180001631827_192_SAC', 'ctg7180001208887_1776_SCT', 'ctg7180001937818_13928_SAG', 'ctg7180001853207_6271_SAG', 'ctg7180001668257_1374_SAG', 'ctg7180001827628_2639_SGT', 'ctg7180001827868_2803_SAC', 'ctg7180001474449_216_SGT']

Mowi: ['ctg7180001903803_1531_SCT', 'ctg7180001268296_4006_SCT', 'ctg7180001851039_10290_SAC', 'ctg7180001888084_235_SCT', 'ctg7180001863290_453_SCT', 'ctg7180001593480_3370_SAC', 'ctg7180001833869_486_SCT', 'ctg7180001591304_4622_SGT', 'ctg7180001538584_4406_SGT', 'ctg7180001809345_1074_SCT', 'ctg7180001626552_1091_SAG', 'ctg7180001631827_192_SAC', 'ctg7180001295039_234_SAG', 'ctg7180001925561_4576_SAC', 'ctg7180001933798_3460_SGT', 'ctg7180001721295_376_SCT']

Rauma:
['ctg7180001825403_10894_SAG', 'ctg7180001850393_8798_SCT', 'ctg7180001900396_1652_SCT', 'ctg7180001591304_4622_SGT', 'ctg7180001883233_10351', 'ctg7180001809345_1074_SCT', 'ctg7180001289769_2604_SCT', 'ctg7180001787680_1094_SAC', 'ctg7180001628780_3092_SAG', 'ctg7180001858455_7377_SAG', 'ctg7180001552685_1089_SGT', 'ctg7180001934773_3779_SCT', 'ctg7180001936744_2288_SCT']

SNPene markert i farger er felles.

For et gitt gen (eller protein) søkte vi spesifikt med stikkordene: neuronal, disease, sensory, olfactory, development. I enkelte tilfeller fulgte vi opp med mer spesifikke ord som dopamine, serotonin, etc der det var tydelige leads til nevrotransmittor-biologien. I all hovedsak har treffene vært på pattedyr. Vi har ikke vært systematisk med å søke gjennom alle muligheter der det er ulike navn for ett gen.

For hver SNP er alle gener innenfor et vindu på ±50 Kb listet og sjekket. I noen tilfeller er det ingen gener i dette området, og da er de to nærmeste flankerende genene sjekket.

Studien er å betrakte som innledende og ønsker kun å vise om det finnes evidens i litteraturen på at et gitt gen kan assosieres med biologi som er av betydning for ferskcannsoppvandringsevne. Den kan bli fulgt opp med bruk av mer avanserte verktøy for å avdekke fysiologiske krysskoblinger mellom gener.

AquaGen

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
7509	ctg7180001900376_8301_SAG	functional	ssa14	61498291	missense_variant	LOC106569887	c.547C>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Pı
356848	106569883	14:61399221:61530689	ctg7180001900376_8301_SAG	14.0	61449221.0	61480689.0	LOC106569883	synaptotagmin-11-like	protein_coding	XI
356884	106569887	14:61439530:61549630	ctg7180001900376_8301_SAG	14.0	61489530.0	61499630.0	LOC106569887	GTP-binding protein Rit1-like	protein_coding	XI
356907	106569885	14:61449749:61554780	ctg7180001900376_8301_SAG	14.0	61499749.0	61504780.0	pex11b	peroxisomal membrane protein 11B isoform X2	protein_coding	XI

	References
synaptotagmin-11	Wang, C., Kang, X., Zhou, L. *et al.* (2018) "Synaptotagmin-11 is a critical mediator of parkin-linked neurotoxicity and Parkinson's disease-like pathology" Nature Communications, 9: 81 Wang, C., Wang, Y., Hu, M. *et al.* (2016) "Synaptotagmin-11 inhibits clathrin-mediated and bulk endocytosis" EMBO reports, 17: 47-63. Yeo, H., Kim, H., Mo, J. *et al.* (2012) "Developmental expression and subcellular distribution of synaptotagmin 11 in rat hippocampus" Neuroscience, 225: 35-43. Shimojo, M., Madara, J., Pankow, S. *et al.* (2019) "Synaptotagmin-11 mediates a vesicle trafficking pathway that is essential for development and synaptic plasticity" Genes & Dev, 33: 365-376.
GTP-binding protein Rit1	No clear association
peroxisomal membrane protein 11B isoform X2	Ahlemeyer, B., Gottwald, M., and Baumgart-Vogt, E. (2012) "Deletion of a single allele of the Pex11β gene is sufficient to cause oxidative stress, delayed differentiation and neuronal death in mouse brain" Disease Models Mechanisms, 5: 125-140.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
16587	ctg7180001335371_3683_SAC	Distribution-SNP	ssa01	125843487	intergenic_region	LOC106565750-LOC106563392	n.125843487T>G

GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Protein_product	Strand	Len	Row_no	Gid

	References
LOC106565750	No info
piggyBac transposable element-derived protein 4	Appears to have some link to neuro- and olfactory biology:

	Dang, P., Fisher, S. A., Stefanik, D., Kim, J., & Raper, J. A. (2018) “Coordination of olfactory receptor choice with guidance receptor expression and function in olfactory sensory neurons” PLoS Genetics, 14: e1007164. Khuansuwan, S. (2014) “A transcription factor network dictates neuronal cell fate decisions in the zebrafish dorsal diencephalon” PhD Thesis, Vanderbilt University, USA, https://Etd.Library.Vanderbilt.Edu/Available/Etd-09242014-175729/Unrestricted/KhuansuwanDissertationFinal.Pdf Pavelitz, T., Gray, L. T., Padilla, S. L., Bailey, A. D., & Weiner, A. M. (2013) “PGBD5: A neural-specific intron-containing piggyBac transposase domesticated over 500 million years ago and conserved from cephalochordates to humans” Mobile DNA, 4: 23. Yang, J., Yan, B., Fan, Y., Yang, L., Zhao, B., Zhu, F., … Ma, X. (2019) “Identification of schizophrenia related biological pathways across eight brain regions” Behavioural Brain Research, 360: 1–6. Matsunami, N., Hensel, C. H., Baird, L., Stevens, J., Otterud, B., Leppert, T., … Leppert, M. F. (2014) “Identification of rare DNA sequence variants in high-risk autism families and their prevalence in a large case/control population” Molecular Autism, 5: 5.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
276	ctg7180001805519_4864_SAG	rsb	ssa09	128631600	intron_variant	stim1	c.939+234A>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
234493	106613200	9:128543777:128650112	ctg7180001805519_4864_SAG	9.0	128593777.0	128600112.0	LOC106613200	short transient receptor potential channel 2-like	protein_coding
234524	100380565	9:128561136:128736931	ctg7180001805519_4864_SAG	9.0	128611136.0	128686931.0	stim1	stromal interaction molecule 1 isoform X2	protein_coding

	References
short transient receptor potential channel 2	Williams, C., Gallagher, E., Dittman, A. *et al.* (2018) “Elevated carbon dioxide alters neural signaling and anti-predator behaviors in ocean phase coho salmon (Oncorhynchus kisutch)” Presentation 2018 Salish Sea Ecosytem Conference (Seattle, Wash.) Harteneck, C., Plant, T. D., & Schultz, G. (2000) “From worm to man: three subfamilies of TRP channels” Trends Neurosci, 23: 159–166. Vennekens, R., Voets, T., Bindels, R. J. M., Droogmans, G., & Nilius, B. (2002) “Current understanding of mammalian TRP homologues” Cell Calcium, 31: 253–264.

	Qiu, J., Fang, Y., Rønnekleiv, O. K., & Kelly, M. J. (2010) ”Leptin excites proopiomelanocortin neurons via activation of TRPC channels” The Journal of Neuroscience, 30: 1560–1565. Sohn, J. W., Xu, Y., Jones, J. E., Wickman, K., Williams, K. W., & Elmquist, J. K. (2011) ”Serotonin 2C receptor activates a distinct population of arcuate pro-opiomelanocortin neurons via TRPC channels” Neuron, 71: 488–497. Huang, W. C., Young, J. S., & Glitsch, M. D. (2007) “Changes in TRPC channel expression during postnatal development of cerebellar neurons” Cell Calcium, 42: 1–10. El-Hassar, L., Hagenston, A. M., D’Angelo, L. B., & Yeckel, M. F. (2011) “Metabotropic glutamate receptors regulate hippocampal CA1 pyramidal neuron excitability via Ca 2+ wave-dependent activation of SK and TRPC channels” Journal of Physiology, 589: 3211–3229. Li, Y., Jia, Y., Cui, K., Li, N., Zheng, Z., Wang, Y., & Yan, X. (2005) “Essential role of TRPC channels in the guidance of nerve growth cones by brain-derived neurotrophic factor” Nature, 434: 894–898. Selvaraj, S., Sun, Y., & Singh, B. (2010) ”TRPC Channels and their Implications for Neurological Diseases” CNS & Neurological Disorders - Drug Targets, 9: 94–104. Stroh, O., Freichel, M., Kretz, O., Birnbaumer, L., Hartmann, J., & Egger, V. (2012) “NMDA receptor-dependent synaptic activation of TRPC channels in olfactory bulb granule cells. The Journal of Neuroscience”, 32: 5737–5746. Davies, R., Hayat, S., Wigley, C. B., & Robbins, J. (2004) “The calcium influx pathway in rat olfactory ensheathing cells shows TRPC channel pharmacology” Brain Research, 1023: 154–156. Wang, Y., Teng, H. L., Gao, Y., Zhang, F., Ding, Y. Q., & Huang, Z. H. (2016) “Brain-derived Neurotrophic Factor Promotes the Migration of Olfactory Ensheathing Cells Through TRPC Channels” GLIA, 64: 2154–2165. Badsha, F., Kain, P., Prabhakar, S., Sundaram, S., Padinjat, R., Rodrigues, V., & Hasan, G. (2012) “Mutants in Drosophila TRPC Channels Reduce Olfactory Sensitivity to Carbon Dioxide” PLoS ONE, 7: e49848. Freichel, M., Vennekens, R., Olausson, J., Hoffmann, M., Müller, C., Stolz, S., … Flockerzi, V. (2004) “Functional role of TRPC proteins in vivo: lessons from TRPC-deficient mouse models” Biochemical and Biophysical Research Communications, 322: 1352–1358.

	Zufall, F. (2005) “The TRPC2 ion channel and pheromone sensing in the accessory olfactory system” Naunyn-Schmiedeberg’s Archives of Pharmacology, 371: 245–250. Zufall F. (2014) “TRPs in Olfaction”. In: Nilius B., Flockerzi V. (eds) Mammalian Transient Receptor Potential (TRP) Cation Channels. Handbook of Experimental Pharmacology, vol 223. Springer, Cham
stim1	Skibinska-Kijek, M., Wisniewska, M. B., Gruszczynska-Biegala, J., *et al.* (2009) “Immunolocalization of STIM1 in the mouse brain” Acta Neurobiol Exp (Wars), 69: 413-428. Sun, Y., Zhang, H., Selvaraj, S. *et al.* (2017) ”Inhibition of L-type Ca^{2+} channels by TRPC1-STIM1 complex is essential for the protection of dopaminergic neurons” The Journal of Neuroscience, 37: 3364-3377. Shim, S., Zheng, J. Q., and Ming, G. (20013) “A critical role for STIM1 in filopodial calcium entry and axon guidance” Molecular Brain, 6: 51.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
29727	ctg7180001281527_848_SCT	Distribution-SNP	ssa11	91377549	intron_variant	LOC106563916	c.754+3603C>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	P
287222	106563914	11:91246349:91380703	ctg7180001281527_848_SCT	11.0	91296349.0	91330703.0	tmem135	transmembrane protein 135	protein_coding	X
287224	106563916	11:91320151:91498889	ctg7180001281527_848_SCT	11.0	91370151.0	91448889.0	LOC106563916	metabotropic glutamate receptor 5-like	protein_coding	X

	References
Tmem135	No clear association
metabotropic glutamate receptor 5	Awad, H., Hubert, G., Smith, Y. et al. (2000) “Activation of metabotropic glutamate receptor 5 has direct excitatory effects and potentiates NMDA receptor currents in neurons of the subthalamic nucleus” The Journal of Neuroscience, 20: 7871-7879. Byrnes, K., Stoica, B., Loane, D. et al. (2009) “Metabotropic Glutamate Receptor 5 Activation Inhibits Microglial Associated Inflammation and Neurotoxicity” GLIA, 57: 550-560. Ferraguti, F. and Shigemoto, R. (2006) “Metabotropic glutamate receptors” Cell Tissue Res, 326: 483-504. Simonyi, A., Schachtman, T. R., and Christoffersen, G. R. (2005) “The role of metabotropic glutamate receptor 5 in learning and memory processes” Drug News & Perspectives, 18: 353-361. Rodrigues, S. M., Bauer, E. P, Farb, C. R. *et al.* (2002) “The Group I Metabotropic Glutamate Receptor mGluR5 Is Required for Fear Memory Formation and Long-Term Potentiation in the Lateral Amygdala” The Journal of Neuroscience, 22: 5219-5229.

	Lu, Y.-M., Jia, Z., Janus, J. *et al.* (1997) “Mice Lacking Metabotropic Glutamate Receptor 5 Show Impaired Learning and Reduced CA1 Long-Term Potentiation (LTP) But Normal CA3 LTP” The Journal of Neuroscience, 17: 5196-5205.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
6260	ctg7180001891409_3634_SCT	functional	ssa09	77924878	missense_variant	tmem173	c.643G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
221069	106612112	9:77811366:77964559	ctg7180001891409_3634_SCT	9.0	77861366.0	77914559.0	LOC106612112	serine/threonine-protein phosphatase 2B cataly...	protein_coding
221078	106612120	9:77867692:77976027	ctg7180001891409_3634_SCT	9.0	77917692.0	77926027.0	tmem173	stimulator of interferon genes protein	protein_coding
221089	106612111	9:77881114:77984955	ctg7180001891409_3634_SCT	9.0	77931114.0	77934955.0	LOC106612111	DNA damage-inducible transcript 4-like protein	protein_coding
221096	106612110	9:77885241:77996262	ctg7180001891409_3634_SCT	9.0	77935241.0	77946262.0	LOC106612110	bromodomain-containing protein 8-like isoform X3	protein_coding
221107	106612109	9:77901443:78071805	ctg7180001891409_3634_SCT	9.0	77951443.0	78021805.0	LOC106612109	muscleblind-like protein 3 isoform X10	protein_coding

	References
serine/threonine-protein phosphatase 2B cataly..	Gold, B. G. (1997) “FK506 and the Role of Immunophilins in Nerve Regeneration” Molecular Neurobiolog, 15: 285-306. Dimatelis, J. J., Hsieh, J. H., Sterley, T.-L. *et al.* (2015) “Impaired Energy Metabolism and Disturbed Dopamine and Glutamate Signalling in the Striatum and Prefrontal Cortex of the Spontaneously Hypertensive Rat Model of Attention-Deficit Hyperactivity Disorder” J. Mol. Neurosci., 56: 696-707. Bernstein, H.-G., Dobrowolny, H., Schott, B. H. *et al.* (2013) “Increased density of AKAP5-expressing neurons in the anterior cingulate cortex of subjects with bipolar disorder” Journal of Psychiatric Research, 47: 699-705.
tmem173	No clear association, but a few relevant hits: Patel, S., & Jin, L. (2019) “TMEM173 variants and potential importance to human biology and disease” Genes & Immunity, 20: 82–89. Liu, Y., & Cherry, S. (2019) “Zika virus infection activates sting-dependent antiviral autophagy in the Drosophila brain” Autophagy, 15: 174–175. Hickman, S. E., Kingery, N. D., Ohsumi, T. K., Borowsky, M. L., Wang, L. C., Means, T. K., & El Khoury, J. (2013) “The microglial sensome revealed by direct RNA sequencing” Nature Neuroscience, 16: 1896–1905.

	LaFlamme, B. (2014) “NF-κβ signaling disrupted in neurodevelopmental disorders” Nature Genetics, 46: 933. Liu, S., & Guan, W. (2018) “STING signaling promotes apoptosis, necrosis, and cell death: An overview and update” Mediators of Inflammation, 2018: 1202797. Ranoa, D. R. E., Widau, R. C., Mallon, S., Parekh, A. D., Nicolae, C. M., Huang, X., … Weichselbaum, R. R. (2019) “STING promotes homeostasis via regulation of cell proliferation and chromosomal stability” Cancer Research, 79: 1465–1479.
DNA damage-inducible transcript 4 protein	No clear association
bromodomain-containing protein 8	No clear association
muscleblind-like protein 3 isoform X10	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
6582	ctg7180001797454_43093_SAG	functional	ssa10	79356907	missense_variant	nup93	c.1445A>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep
255127	106560849	10:79249880:79368353	ctg7180001797454_43093_SAG	10.0	79299880.0	79318353.0	LOC106560849	cholesteryl ester transfer protein-like
255161	100380390	10:79269345:79387287	ctg7180001797454_43093_SAG	10.0	79319345.0	79337287.0	herp1	Homocysteine-responsive endoplasmic reticulum-...
255186	106560848	10:79288130:79396381	ctg7180001797454_43093_SAG	10.0	79338130.0	79346381.0	LOC106560848	solute carrier family 12 member 3-like
255214	100195319	10:79298829:79432071	ctg7180001797454_43093_SAG	10.0	79348829.0	79382071.0	nup93	nuclear pore complex protein Nup93 isoform X1
255240	100136581	10:79333857:79434867	ctg7180001797454_43093_SAG	10.0	79383857.0	79384867.0	LOC100136581	metallothionein B
255293	106560847	10:79343568:79451725	ctg7180001797454_43093_SAG	10.0	79393568.0	79401725.0	LOC106560847	UDP-GlcNAc:betaGal beta-1 a
255319	106560845	10:79353228:79462519	ctg7180001797454_43093_SAG	10.0	79403228.0	79412519.0	LOC106560845	UPF0183 protein C16orf70 homolog isoform X2

	References
cholesteryl ester transfer protein	No clear association
herp1	Shi, N., & Chen, S. Y. (2015) “From nerve to blood vessel: a new role of Olfm2 in smooth muscle differentiation from human embryonic stem cell-derived mesenchymal cells” The Journal of Biomedical Research, 29: 261–263.

	Iso, T., Kedes, L., & Hamamori, Y. (2003) "HES and HERP families: Multiple effectors of the Notch signaling pathway" Journal of Cellular Physiology, 194: 237–255. Yoon, K., & Gaiano, N. (2005) "Notch signaling in the mammalian central nervous system: Insights from mouse mutants" Nature Neuroscience, 8: 709–715. Bianchi, S., Dotti, M. T., & Federico, A. (2006) "Physiology and Pathology of Notch Signalling System" Journal of Cellular Physiology, 207: 300–308.
solute carrier family 12 member 3-like	No clear association
nup93	Labade, A. S., Salvi, A., Karmodiya, K. *et al.* (2019) "Nup93 modulates spatiotemporal dynamics and function of the HOXA gene cluster during differentiation" bioRxiv, DOI: 10.1101/646224. Dacheta, F., Liua, J., Ravits, J. *et al.* (2019) "Predicting disease specific spinal motor neurons and glia in sporadic ALS" Neurobiology of Disease, 130: 104523. Shamseldin, H. E., Makhseed, N., Ibrahim, N. *et al.* (2019) "NUP214 deficiency causes severe encephalopathy and microcephaly in humans" Human Genetics, 138: 221-229.
metallothionein B	No clear association
UDP-GlcNAc:betaGal beta-1,3-N-acetylglucosaminyltransferase 9	No clear association
UPF0183 protein C16orf70 homolog	Hirokawa, N. and Takemura, R. (2005) "Molecular motors and mechanisms of directional transport in neurons" Nature Reviews Neuroscience, 6: 201-214. Namba, T., Nakamuta, S., Funahashi, Y. *et al.* (2011) "The Role of Selective Transport in Neuronal Polarization" Developmental Neurobiology, 71: 445-457. Tomita, S., Fujita, T., Kirino, Y. *et al.* (2000) "PDZ Domain-dependent Suppression of NF-?B/p65-induced Aβ42 Production by a Neuron-specific X11-like Protein" The Journal of Biological Chemistry, 275: 13056-13060. Spiegel, I, Salomon, D., Erne, B. *et al.* (2002) "Caspr3 and Caspr4, Two Novel Members of the Caspr Family Are Expressed in the Nervous System and Interact with PDZ Domains" Molecular and Cellular Neuroscience, 20: 283-297. Hirokawa, N., Noda, Y., Tanaka, Y. *et al.* (2009) "Kinesin superfamily motor proteins and intracellular transport" Nature Reviews Molecular Cell Biology, 10: 682-696.

	Collingridge, G. L., Volianskis, A., Bannister, N. *et al.* (2013) “The NMDA receptor as a target for cognitive enhancement” Neuropharmacology, 64:13-26. Schmid, A. (2006) “The role of glutamate receptors in formation and maturation of Drosophila neuromuscular synapses Dissertation” PhD thesis, Göttingen. Shantanu, P. A., Sharma, D., Sharma. M. *et al.* (2019) “Kinesins: Motor Proteins as Novel Target for the Treatment of Chronic Pain” Molecular Neurobiology, 56: 3854-3864.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
9459	ctg7180001857660_10743_SAG	functional	ssa27	4563122	missense_variant	LOC106588229	c.1276G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
559901	106588227	27:4466072:4593305	ctg7180001857660_10743_SAG	27.0	4516072.0	4543305.0	fbxl6	F-box/LRR-repeat protein 6	protein_coding	›
559913	106588226	27:4493094:4598515	ctg7180001857660_10743_SAG	27.0	4543094.0	4548515.0	LOC106588226	uncharacterized protein LOC106588226	protein_coding	›
559932	106588228	27:4492197:4605706	ctg7180001857660_10743_SAG	27.0	4542197.0	4555706.0	slc52a2	solute carrier family 52	riboflavin transporter	
559959	106588229	27:4507526:4614443	ctg7180001857660_10743_SAG	27.0	4557526.0	4564443.0	LOC106588229	riboflavin transporter 2-like	protein_coding	›
560003	106588230	27:4526769:4699130	ctg7180001857660_10743_SAG	27.0	4576769.0	4649130.0	LOC106588230	nuclear factor of activated T-cells	cytoplasmic 1-like isoform X2	

	References
fbxl6	No clear association
LOC106588226	No info
slc52a2	Possibly a slight association: Haack, T. *et al.* (2012) “Impaired riboflavin transport due to missense mutations in SLC52A2 causes Brown-Vialetto-Van Laere syndrome” Journal of Inherited Metabolic Disease, 35: 943-948. Babanejad, M. *et al.* (2018) “SLC52A2 mutations cause SCABD2 phenotype: A second report” International Journal of Pediatric Otorhinolaryngology, 104: 195-199. Yonezawa, A. and Inui, K. (2013) “Novel riboflavin transporter family RFVT/SLC52: Identification, nomenclature, functional characterization and genetic diseases of RFVT/SLC52” Molecular Aspects of Medicine, 34: 693-701.
riboflavin transporter 2	Jaeger, B. and Bosch, A. M. (2016) “Clinical presentation and outcome of riboflavin transporter deficiency: mini review after five years of experience” Journal of Inherited Metabolic Disease, 39: 559-564.

	Manole A. and Houlden H. (2015) Riboflavin transporter deficiency neuronopathy. In: Pagon RA, Adam MP, Ardinger HH (eds) GeneReviews® [Internet]. University of Washington, Seattle, 1993–2015. Available from http://www.ncbi.nlm.nih.gov/books/ Google Scholar Biswas, A. *et al.* (2013) "Identification and Functional Characterization of the Caenorhabditis elegans Riboflavin Transporters rft-1 and rft-2" PLoS ONE, 8: e58190. O'Callaghan, B. *et al.* (2019) "An update on the genetics, clinical presentation, and pathomechanisms of human riboflavin transporter deficiency" Journal of inherited metabolic disease, 42: 598-607.
nuclear factor of activated T-cells, cytoplasmic 1 (NFATc1)	Hernández-Ochoa, E. O. *et al.* (2007) "Ca2+ signal summation and NFATc1 nuclear translocation in sympathetic ganglion neurons during repetitive action potentials" Cell Calcium, 41: 559-571. Vihma, H. *et al.* (2016) "Regulation of different human NFAT isoforms by neuronal activity" Journal of Neurochemistry, 137: 394-408. Pérez-Ortiz, J. M. *et al.* (2008) "Mechanical lesion activates newly identified NFATc1 in primary astrocytes: Implication of ATP and purinergic receptors" European Journal of Neuroscience, 27: 2453-2465. Luo, J. *et al.* (2014) "A calcineurin- and NFAT-dependent pathway is involved in α-synuclein-induced degeneration of midbrain dopaminergic neurons" Hum. Mol. Genet., 23: 6567–6574. Vihma, H. and Timmusk, T. (2017) "Sumoylation regulates the transcriptional activity of different human NFAT isoforms in neurons" Neuroscience Letters, 653: 302-307. Shetty, R. S. *et al.* (2005) "Transcriptional changes during neuronal death and replacement in the olfactory epithelium" Molecular and Cellular Neuroscience, 30: 90-107. Vihma, H. *et al.* (2008) "Alternative splicing and expression of human and mouse NFAT genes" Genomics, 92: 279-291. Wong, K. S. *et al.* (2012) "Hedgehog signaling is required for differentiation of endocardial progenitors in zebrafish" Developmental Biology, 361: 377-391.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
6570	ctg7180001870716_3401_SCT	functional	ssa10	74406853	missense_variant	saps3	c.2149T>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
253104	106560967	10:74295703:74409227	ctg7180001870716_3401_SCT	10.0	74345703.0	74359227.0	LOC106560967	protein lin-54 homolog isoform X1	protein_coding	)
253132	106561117	10:74313642:74418031	ctg7180001870716_3401_SCT	10.0	74363642.0	74368031.0	LOC106561117	galanin peptides-like isoform X2	protein_coding	)
253163	106560965	10:74319992:74447059	ctg7180001870716_3401_SCT	10.0	74369992.0	74397059.0	LOC106560965	sodium/hydrogen exchanger 10-like	protein_coding	)
253187	100380307	10:74353119:74470679	ctg7180001870716_3401_SCT	10.0	74403119.0	74420679.0	saps3	SAPS domain family	member 3 isoform X5	
253202	106560964	10:74376206:74527993	ctg7180001870716_3401_SCT	10.0	74426206.0	74477993.0	LOC106560964	low-density lipoprotein receptor-related prote...	protein_coding	)
596355	106560966	10:74318551:74419847	ctg7180001870716_3401_SCT	NaN	74368551.0	74369847.0	LOC106560966	NaN	lncRNA	
596550	106561118	10:74309816:74411378	ctg7180001870716_3401_SCT	NaN	74359816.0	74361378.0	LOC106561118	NaN	lncRNA	

	References
protein lin-54	No clear association
galanin peptides	Gundlach, A. L. (2002) "Galanin/GALP and galanin receptors: Role in central control of feeding, body weight/obesity and reproduction?" European Journal of Pharmacology, 440: 255-268. De Lecea, L. *et al.* (1998) "The hypocretins: Hypothalamus-specific peptides with neuroexcitatory activity" Proceedings of the National Academy of Sciences USA, 95: 322-327. Lang, R. *et al.* (2015) "Physiology, Signaling, and Pharmacology of Galanin Peptides and Receptors: Three Decades of Emerging Diversity" Pharmacological Reviews, 67:118-175. Landry, M. *et al.* (2003) "Differential routing of coexisting neuropeptides in vasopressin neurons" European Journal of Neuroscience, 17: 579-589.
sodium/hydrogen exchanger 10	No clear association
saps3	Pawlowski, T. L. *et al.* (2009) "Candidate Agtr2 influenced genes and pathways identified by expression profiling in the developing brain of Agtr2 -/y mice" Genomics, 94: 188-195.
low-density lipoprotein receptor-related protein 5	No clear association
LOC106560966	No info
LOC106561118	No info

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
5761	ctg7180001793773_4907	functional	ssa06	38936265	missense_variant	LOC106607255	c.1271T>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
161534	106607256	6:38816261:38974305	ctg7180001793773_4907	6.0	38866261.0	38924305.0	LOC106607256	gap junction gamma-1 protein-like	protein_coding
161577	106607255	6:38885676:38993848	ctg7180001793773_4907	6.0	38935676.0	38943848.0	LOC106607255	alpha-2	8-sialyltransferase 8E-like isoform X2
161590	100196552	6:38932124:39034658	ctg7180001793773_4907	6.0	38982124.0	38984658.0	rl19	60S ribosomal protein L19	protein_coding

	References
gap junction gamma-1 protein	No clear association
alpha-2,8-sialyltransferase 8E	Gouveia, R. *e al.* (2012) "Expression of glycogenes in differentiating human NT2N neurons. Downregulation of fucosyltransferase 9 leads to decreased Lewisx levels and impaired neurite outgrowth" Biochimica et Biophysica Acta, 1820: 2007-2019. Schengrund, C.-L. (2015) "Gangliosides: Glycosphingolipids essential for normal neural development and function" Trends in Biochemical Sciences, 40: 397-406. Schneider, J. S. (2018) "Altered expression of genes involved in ganglioside biosynthesis in substantia nigra neurons in Parkinson's disease" PLoS ONE, 13: e0199189. Yu R.K., Itokazu Y. (2014) Glycolipid and Glycoprotein Expression During Neural Development. In: Yu R., Schengrund CL. (eds) Glycobiology of the Nervous System. Advances in Neurobiology, vol 9. Springer, New York, NY. Sivasankaran, A. *et al.* (2015) "Split Hand/Foot Malformation Associated with 7q21.3 Microdeletion: A Case Report" Molecular Syndromology, 6: 287-296.
rl19	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
470	ctg7180001912369_4971_SAG	rsb	ssa17	6071248	synonymous_variant	LOC106575232	c.2088G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
408296	106575232	17:5949168:6127556	ctg7180001912369_4971_SAG	17.0	5999168.0	6077556.0	LOC106575232	zinc finger E-box-binding homeobox 2-like isof...	protein_coding

	References
zinc finger E-box-binding homeobox 2	McKinsey, G. L. *et al.* (2013) "Dlx1&2-Dependent Expression of Zfhx1b (Sip1, Zeb2) Regulates the Fate Switch between Cortical and Striatal Interneurons" Neuron, 77: 83-98. Hegarty, S. V. *et al.* (2015) "Zeb2: A multifunctional regulator of nervous system development" Progress in Neurobiology, 132: 81-95. Yamada, Y. *et al.* (2014) "The spectrum of ZEB2 mutations causing the Mowat-Wilson syndrome in Japanese populations" American Journal of Medical Genetics, Part A, 164A: 1899-1908. Hegarty, S. V. *et al.* (2017) "Zeb2 is a negative regulator of midbrain dopaminergic axon growth and target innervation" Scientific Reports, 7: 8568. Quintes, S. *et al.* (2016) "Zeb2 is essential for Schwann cell differentiation, myelination and nerve repair" Nature Neuroscience, 19: 1050-1059. Kropivšek, K. *et al.* (2014) "Postnatal dynamics of zeb2 expression in rat brain: Analysis of novel 3' UTR sequence reveals a mir-9 interacting site" Journal of Molecular Neuroscience, 52: 138-147. Volk, D. W. and Lewis, D. A. (2014)"Early developmental disturbances of cortical inhibitory neurons: Contribution to cognitive deficits in schizophrenia" Schizophrenia Bulletin, 40: 952-957. Watanabe, Y. *et al.* (2017) "Differentiation of Mouse Enteric Nervous System Progenitor Cells Is Controlled by Endothelin 3 and Requires Regulation of Ednrb by SOX10 and ZEB2" Gastroenterology, 152: 1139-1150. Yang, S. *et al.* (2018) "A Zeb2-miR-200c loop controls midbrain dopaminergic neuron neurogenesis and migration" Communications Biology, 1:75.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
25482	ctg7180001679281_5789_SAC	Distribution-SNP	ssa09	67730491	upstream_gene_variant	LOC106611890	c.-4406G>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
218625	106611902	9:67614664:67739614	ctg7180001679281_5789_SAC	9.0	67664664.0	67689614.0	LOC106611902	serine/threonine-protein phosphatase 2A 55 kDa...	protein_coding
218630	106611897	9:67651772:67756927	ctg7180001679281_5789_SAC	9.0	67701772.0	67706927.0	LOC106611897	zinc finger protein 500-like isoform X2	protein_coding
218645	106611896	9:67660852:67767872	ctg7180001679281_5789_SAC	9.0	67710852.0	67717872.0	LOC106611896	zinc finger protein 878-like isoform X2	protein_coding
218656	106611890	9:67668813:67776488	ctg7180001679281_5789_SAC	9.0	67718813.0	67726488.0	LOC106611890	zinc finger protein 629-like	protein_coding
218666	106611891	9:67676894:67780898	ctg7180001679281_5789_SAC	9.0	67726894.0	67730898.0	LOC106611891	zinc finger protein 213-like isoform X1	protein_coding
218674	106611894	9:67682147:67783932	ctg7180001679281_5789_SAC	9.0	67732147.0	67733932.0	LOC106611894	zinc finger protein 782-like	protein_coding
218690	106611893	9:67684831:67787883	ctg7180001679281_5789_SAC	9.0	67734831.0	67737883.0	LOC106611893	zinc finger protein 629-like	protein_coding
218701	106611892	9:67688192:67790239	ctg7180001679281_5789_SAC	9.0	67738192.0	67740239.0	LOC106611892	zinc finger protein 232-like isoform X2	protein_coding
218712	100196518	9:67703329:67804472	ctg7180001679281_5789_SAC	9.0	67753329.0	67754472.0	mif	Macrophage migration inhibitory factor	protein_coding
218733	106611889	9:67707775:67811550	ctg7180001679281_5789_SAC	9.0	67757775.0	67761550.0	LOC106611889	uncharacterized protein LOC106611889	protein_coding
218749	106611888	9:67711705:67825173	ctg7180001679281_5789_SAC	9.0	67761705.0	67775173.0	LOC106611888	E3 ubiquitin-protein ligase BRE1A-like isoform X2	protein_coding
218753	100136522	9:67728285:67832819	ctg7180001679281_5789_SAC	9.0	67778285.0	67782819.0	aldob	fructose-bisphosphate aldolase B	protein_coding

	References
serine/threonine-protein phosphatase 2A 55 kDa regulatory subunit B gamma isoform	No clear association
zinc finger protein 500	No clear association
zinc finger protein 878	No clear association
finger protein 629	No clear association
myeloid zinc finger 1	Li, Z. *et al.* (2015) "Dorsal root ganglion myeloid zinc finger protein 1 contributes to neuropathic pain after peripheral nerve trauma" Pain, 156: 711-721. Kim, J. *et al.* (2015)"A regulatory gene network related to the porcine umami taste receptor (TAS1R1/TAS1R3)" Animal Genetics, 47: 114-119.
zinc finger protein 782	No clear association
zinc finger protein 629	No clear association
zinc finger protein 232	No clear association
Mif	Nishibori, M. *et al.* (1996) "Presence of macrophage migration inhibitory factor (MIF) in ependyma, astrocytes and neurons in the bovine brain" Neuroscience Letters, 213: 193-196.

	Kostrzewa, R. M. *et al.* (1976) "Effects of L-prolyl-L-leucyl-glycine amide (MIF-I) on dopaminergic neurons" Pharmacology, Biochemistry and Behavior, 5: 125-127. Kostrzewa, R. M. *et al.* (1979) "Striatal dopamine turnover and MIF-I" Brain Research Bulletin, 4: 799-802. Kostrzewa, R. M. *et al.* (1979) "MIF-I and postsynaptic receptor sites for dopamine" Brain Research Bulletin, 4: 657-662. Hlinák, Z. and Krejcí, I. (1991) "Social recognition in male rats: Age differences and modulation by MIF-2 and Alaptide" Physiol. Res., 40: 59-67. Hlinák, Z. and Krejcí, I. (1991) "Modulation of social memory in rats by alaptide, a derivative of MIF" Homeostasis Health Dis., 33: 262–273.
LOC106611889	No info
E3 ubiquitin-protein ligase BRE1A	No clear association
Aldob	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
34	ctg7180001885038_4967_SAC	rsb	ssa02	9269382	upstream_gene_variant	acbd7	c.-2822T>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
43087	106576009	2:9141578:9272767	ctg7180001885038_4967_SAC	2.0	9191578.0	9222767.0	LOC106576009	multidrug resistance protein 1-like	protein_coding
43093	106576069	2:9173944:9293888	ctg7180001885038_4967_SAC	2.0	9223944.0	9243888.0	LOC106576069	peroxisomal carnitine O-octanoyltransferase-like	protein_coding
43094	100196088	2:9209079:9316642	ctg7180001885038_4967_SAC	2.0	9259079.0	9266642.0	acbd7	acyl-CoA-binding domain-containing protein 7	protein_coding
43101	100196857	2:9217121:9319183	ctg7180001885038_4967_SAC	2.0	9267121.0	9269183.0	rpp38	ribonuclease P protein subunit p38 isoform X1	protein_coding
43105	106576081	2:9220386:9329163	ctg7180001885038_4967_SAC	2.0	9270386.0	9279163.0	LOC106576081	glycylpeptide N-tetradecanoyltransferase 2 iso...	protein_coding
43107	106576092	2:9233186:9368976	ctg7180001885038_4967_SAC	2.0	9283186.0	9318976.0	fam171a1	LOW QUALITY PROTEIN: protein FAM171A1	partial
621084	106576075	2:9205629:9308605	ctg7180001885038_4967_SAC	NaN	9255629.0	9258605.0	LOC106576075	NaN	lncRNA

	References
multidrug resistance protein 1	A possible association Hirrlinger, J. *et al.* (2002) "Glutathione release from cultured brain cells: Multidrug resistance protein 1 mediates the release of GSH from rat astroglial cells" Journal of Neuroscience Research, 69: 318-326. Molinas, A: *et al.* (2012) "Functional evidence of multidrug resistance transporters (MDR) in rodent olfactory epithelium" PLoS ONE, 7: e36167.
peroxisomal carnitine O-octanoyltransferase	No clear association

acbd7	Lanfray D. and Richard D. (2017) “Emerging Signaling Pathway in Arcuate Feeding-Related Neurons: Role of the Acbd7” Front. Neurosci. 11: 328. Caron, A. and Richard, D. (2017) “Neuronal systems and circuits involved in the control of food intake and adaptive thermogenesis” Annals of the New York Academy of Science, 1391: 35– 53. Lanfray, D. *et al.* (2016) “Involvement of the Acyl-CoA binding domain containing 7 in the control of food intake and energy expenditure in mice” eLife, 5: e11742. Adan R. A. H. *et al.* (2006) “The MC4 receptor and control of appetite” British Journal of Pharmacology, 149: 815-827.
rpp38	Romanov, R. A. *et al.* (2017) “Molecular interrogation of hypothalamic organization reveals distinct dopamine neuronal subtypes” Nature Neuroscience, 20: 176-188. Ding, Q. *et al.* (2007) “Interplay between protein synthesis and degradation in the CNS: physiological and pathological implications” Trends in Neurosciences, 30: 31-36. Romanov, R. *et al.* (2017) “Molecular interrogation of hypothalamic organization reveals distinct dopamine neuronal subtypes” Nature Neuroscience, 20: 176-188.
glycylpeptide N-tetradecanoyltransferase 2	No clear association
fam171a1	Rasila, T. *et al.* (2019) “Astroprincin (FAM171A1, C10orf38): A Regulator of Human Cell Shape and Invasive Growth” American Journal of Pathology, 189: 177-189. Hook, P. *et al.* (2018) “Single-Cell RNA-Seq of Mouse Dopaminergic Neurons Informs Candidate Gene Selection for Sporadic Parkinson Disease” American Journal of Human Genetics, 102: 427-446. Castillo-Morales, A. *et al.* (2019) “Postmitotic cell longevity–associated genes: a transcriptional signature of postmitotic maintenance in neural tissues” Neurobiology of Aging, 74: 147-160. Nurnberger, J. *et al.* (2014) “Identification of pathways for bipolar disorder: A meta-analysis” JAMA Psychiatry, 71: 657-664. Poelmans G. (2011) “Genes and protein networks for neurodevelopmental disorders” PhD thesis, Radboud University.
LOC106576075	No info

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
6249	ctg7180001906456_6568_SGT	functional	ssa09	74670550	missense_variant	tmem129	c.347G>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
219925	100195398	9:74599054:74706544	ctg7180001906456_6568_SGT	9.0	74649054.0	74656544.0	al3a2	fatty aldehyde dehydrogenase isoform X1	protein_coding
219945	106612006	9:74606354:74712462	ctg7180001906456_6568_SGT	9.0	74656354.0	74662462.0	ccdc142	coiled-coil domain-containing protein 142	protein_coding
219960	101448012	9:74613031:74716542	ctg7180001906456_6568_SGT	9.0	74663031.0	74666542.0	slbp	Histone RNA hairpin-binding protein	protein_coding
219976	100380489	9:74618141:74721227	ctg7180001906456_6568_SGT	9.0	74668141.0	74671227.0	tmem129	E3 ubiquitin-protein ligase TM129	protein_coding
219984	106612007	9:74630690:74738123	ctg7180001906456_6568_SGT	9.0	74680690.0	74688123.0	atoh8	protein atonal homolog 8	protein_coding
219994	106611962	9:74641074:74750809	ctg7180001906456_6568_SGT	9.0	74691074.0	74700809.0	st3gal5	lactosylceramide alpha-2	3-sialyltransferase
220004	106611963	9:74652225:74762383	ctg7180001906456_6568_SGT	9.0	74702225.0	74712383.0	polr1a	LOW QUALITY PROTEIN: DNA-directed RNA polymera...	protein_coding
220026	106611965	9:74662660:74768727	ctg7180001906456_6568_SGT	9.0	74712660.0	74718727.0	ptcd3	LOW QUALITY PROTEIN: pentatricopeptide repeat ...	mitochondrial
220040	106611966	9:74668725:74785324	ctg7180001906456_6568_SGT	9.0	74718725.0	74735324.0	immt	MICOS complex subunit MIC60	protein_coding

	References
al3a2	No clear association
ccdc142	No clear association
slbp	No convincing association, but: Li, D. K. *et al.* (2014) “SMN control of RNP assembly: From post-transcriptional gene regulation to motor neuron disease” Seminars in Cell and Developmental Biology, 32: 22-29. Correa, T. *et al.* (2018) “Cytogenomic Integrative Network Analysis of the Critical Region Associated with Wolf-Hirschhorn Syndrome” BioMed Research International, 2018: 5436187. Rutherford, E. L. and Lowery, L. A. (2016) “Exploring the developmental mechanisms underlying Wolf-Hirschhorn Syndrome: Evidence for defects in neural crest cell migration” Developmental Biology, 420: 1-10.
tmem129	No convincing association, but: Simon, R. and Bergmann, A. D: (2008) “Mouse models of Wolf-Hirschhorn syndrome” American Journal of Medical Genetics, Part C, 148C: 275-280. Zhu, B. *et al.* (2017) “ER-associated degradation regulates Alzheimer's amyloid pathology and memory function by modulating γ-secretase activity” Nature Communications, 8:1472.
atoh8	No clear association

st3gal5	Roet, K. C. D. *et al.* (2011) "A meta-analysis of microarray-based gene expression studies of olfactory bulb-derived olfactory ensheathing cells" Experimental Neurology, 229: 10-45. Mohieldin, A. M. *et al.* (2015) "Protein composition and movements of membrane swellings associated with primary cilia" Cellular and Molecular Life Sciences, 72: 2415-2429. Sturgill, E. R. *et al.* (2012) "Biosynthesis of the major brain gangliosides GD1a and GT1b" Glycobiology, 22: 1289-1301. Schnaar, R. *et al.* (2014) "Sialic Acids in the Brain: Gangliosides and Polysialic Acid in Nervous System Development, Stability, Disease, and Regeneration" Physiological Reviews, 94: 461-518. Boccuto, L. *et al.* (2014) "A mutation in a ganglioside biosynthetic enzyme, ST3GAL5, results in salt & pepper syndrome, a neurocutaneous disorder with altered glycolipid and glycoprotein glycosylation" Human Molecular Genetics, 23: 418-433. Li, T. A. *et al.* (2018) "Congenital Disorders of Ganglioside Biosynthesis" Sirtuins in Health and Disease, 156, 63-68. Schneider J.S. (2014) "Gangliosides and Glycolipids in Neurodegenerative Disorders" In: Yu R., Schengrund CL. (eds) Glycobiology of the Nervous System. Advances in Neurobiology, vol 9. Springer, New York, NY. Trottein, F. *et al.* (2009) "Glycosyltransferase and sulfotransferase gene expression profiles in human monocytes, dendritic cells and macrophages" Glycoconjugate Journal, 26: 1259-1274. Wang, H. *et al.* (2016) "Early growth and development impairments in patients with ganglioside GM3 synthase deficiency" Clinical Genetics, 89: 625-629.
polr1a	Noack Watt, K. E. (2016) "The Roles of RNA Polymerase I and III Subunits Polr1c and Polr1d in Craniofacial Development and in Zebrafish Models of Treacher Collins Syndrome" PhD thesis, The University of Kansas Medical Center. Weaver, K. *et al.* (2015) "Acrofacial dysostosis, cincinnati type, a mandibulofacial dysostosis syndrome with limb anomalies, is caused by POLR1A dysfunction" The American Journal of Human Genetics, 96: 765-774. Kara, B. *et al.* (2017) "Severe neurodegenerative disease in brothers with homozygous mutation in POLR1A" European Journal of Human Genetics, 25: 315-323. Dijkstra, A. *et al.* "Capter 5: Autophagic dysfunction and impaired proteasomal activity in the brainstem and olfactory bulb during

	disease progression in Parkinson's" Manuscript in preparation. https://research.vumc.nl/ws/files/455063/chapter%205.pdf
ptcd3	No clear association, but possibly related to neurodegeneration
mmt	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
8196	ctg7180001398466_7983_SAG	functional	ssa18	21420780	missense_variant	LOC106577055	c.161T>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
430080	106577053	18:21284967:21461826	ctg7180001398466_7983_SAG	18.0	21334967.0	21411826.0	ccser2	serine-rich coiled-coil domain-containing prot...	protein_coding
430119	106577055	18:21343600:21478213	ctg7180001398466_7983_SAG	18.0	21393600.0	21428213.0	LOC106577055	SPARC-like	protein_coding
430133	106577056	18:21382148:21494610	ctg7180001398466_7983_SAG	18.0	21432148.0	21444610.0	LOC106577056	protein NDNF-like	protein_coding
430137	106577057	18:21396206:21501857	ctg7180001398466_7983_SAG	18.0	21446206.0	21451857.0	LOC106577057	dnaJ homolog subfamily C member 9-like	protein_coding
430148	106577058	18:21404530:21512649	ctg7180001398466_7983_SAG	18.0	21454530.0	21462649.0	fam149b1	protein FAM149B1 isoform X3	protein_coding
622881	106577077	18:21413432:21520908	ctg7180001398466_7983_SAG	NaN	NaN	NaN	NaN	NaN	NaN

	References
ccser2	No clear association
SPARC	Bhoopathi, P. *et al.* (2011) "SPARC Stimulates neuronal differentiation of medulloblastoma cells via the notch1/STAT3 pathway" Cancer Research, 71: 4908-4919. Gongidi, V. *et al.* (2004) "SPARC-like 1 Regulates the Terminal Phase of Radial Glia-Guided Migration in the Cerebral Cortex" Neuron, 41: 57-69. Kucukdereli, H. *et al.* (2011) "Control of excitatory CNS synaptogenesis by astrocyte-secreted proteins Hevin and SPARC" Proceedings of the National Academy of Sciences, 108: E440-E449. Albrecht, D. *et al.* (2012) "SPARC prevents maturation of cholinergic presynaptic terminals" Molecular and Cellular Neuroscience, 49: 364-374. Jones, E. *et al.* (2011) "Astrocytes Control Glutamate Receptor Levels at Developing Synapses through SPARC-Integrin Interactions" The Journal of Neuroscience, 31: 4154-4165. López-Murcia, F: *et al.* (2015) "SPARC triggers a cell-autonomous program of synapse elimination" Proceedings of the National Academy of Sciences, 112: 13366-13371.

	Au, E. *et al.* (2007) “SPARC from Olfactory Ensheathing Cells Stimulates Schwann Cells to Promote Neurite Outgrowth and Enhances Spinal Cord Repair” The Journal of Neuroscience, 27: 7208-7221. Vincent, A. *et al.* (2008) “SPARC is expressed by macroglia and microglia in the developing and mature nervous system” Developmental Dynamics, 237: 1449-1462. Pellitteri, R. *et al.* (2010) “Biomarkers expression in rat olfactory ensheathing cells” Frontiers in Bioscience, S2: 289-298. Zhu, Y. *et al.* (2010) “Olfactory ensheathing cells: Attractant of neural progenitor migration to olfactory bulb” GLIA, 58: 716-729. Sethi, R. *et al.* (2014) “Olfactory Ensheathing Cells Promote Differentiation of Neural Stem Cells and Robust Neurite Extension” Stem Cell Reviews and Reports, 10: 772-785.
protein NDNF	No clear association
dnaJ homolog subfamily C member 9	No clear association
fam149b1	No clear association, but one hit: Torgersbråten, A. (2014) “A homozygous missense mutation in SLCO1C1 may cause a novel progressive encephalopathy syndrome” A student thesis in medicine, UiO.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
23454	ctg7180001916146_1772_SCT	Distribution-SNP	ssa07	8952124	intron_variant	LOC106608572	c.1218+4151A>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Protein_product
178445	106608572	7:8849913:9066496	ctg7180001916146_1772_SCT	7.0	8899913.0	9016496.0	LOC106608572	cGMP-specific 3\'	5\'-cyclic phosphodiesterase-like isoform X5	protein_coding
663660	106608574	7:8886933:9026482	ctg7180001916146_1772_SCT	NaN	8936933.0	8976482.0	LOC106608574	NaN	lncRNA	NaN

	References
5\'-cyclic phosphodiesterase-like isoform X5	No clear association, but related to retinal disease, so it might be of importance: Ahonen, S. *et al.* (2013) “A CNGB1 Frameshift Mutation in Papillon and Phalène Dogs with Progressive Retinal Atrophy “ PLoS ONE, 8: e72122. Ye, G.J. *et al.* (2016) «Cone-specific promoters for gene therapy of achromatopsia and other retinal diseases” Hum. Gene Ther., 27: 72–82.

	Semba, R. D. *et al.* (2015) “Priorities and trends in the study of proteins in eye research, 1924-2014” Proteomics Clin. Appl., 9: 1105-1122. Swaroop, A. *et al.* (2010) “Transcriptional regulation of photoreceptor development and homeostasis in the mammalian retina” Nature Reviews Neuroscience, 11: 563-576.
lnc RNA	No info

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
29040	ctg7180001845082_7172_SAG	Distribution-SNP	ssa11	47799462	intergenic_region	LOC106563007-LOC106562883	n.47799462T>C

GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Protein_product	Strand	Len	Row_no	Gid

	References
LOC106563007	No info
LOC106562883	No info

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
7909	ctg7180001835143_8201_SGT	functional	ssa16	53681459	missense_variant	LOC106574182	c.250G>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
401016	106574180	16:53517338:53683304	ctg7180001835143_8201_SGT	16.0	53567338.0	53633304.0	kiaa0226	run domain Beclin-1 interacting and cysteine-r...	protein_coding
401020	106574179	16:53586494:53725956	ctg7180001835143_8201_SGT	16.0	53636494.0	53675956.0	LOC106574179	5-hydroxytryptamine receptor 3A-like	protein_coding
401028	106574182	16:53631098:53732008	ctg7180001835143_8201_SGT	16.0	53681098.0	53682008.0	LOC106574182	5-hydroxytryptamine receptor 3A-like isoform X2	protein_coding
401029	106574178	16:53632080:53739041	ctg7180001835143_8201_SGT	16.0	53682080.0	53689041.0	LOC106574178	5-hydroxytryptamine receptor 3A-like	protein_coding
401035	106574177	16:53655851:53778733	ctg7180001835143_8201_SGT	16.0	53705851.0	53728733.0	LOC106574177	uncharacterized protein LOC106574177	protein_coding

	References
kiaa0226	McKnight NC, Mizushima N, Yue Z (2012) “The Cellular Process of Autophagy and Control of Autophagy in Neurons.” In: Yue Z, Chu CT, editors. Autophagy of the Nervous System. Singapore: World Scientific Publishing Co. Pte. Ltd. pp. 3–35. Dasouki, M.J. *et al.* (2011) “The 3q29 microdeletion syndrome: report ofthree new unrelated patients and in silico ‘’RNA binding’’ analysis of the 3q29 region” Am. J. Med. Genet. Part A, 155: 1654–1660.

5-hydroxytryptamine receptor 3A	Chen, R. *et al.* (2012) “Characterization of immature and mature 5-hydroxytryptamine 3A receptor-expressing cells within the adult SVZ-RMS-OB system” Neuroscience, 227: 180-190. Hansson, C. *et al.* (2014) “Influence of ghrelin on the central serotonergic signaling system in mice” Neuropharmacology, 79: 498-505. Davies, P. A. *et al.* (1999) “The 5-HT 3B subunit is a major determinant of serotonin-receptor function” Nature, 397: 359-363. Michel, K. *et al.* (2005) Serotonin excites neurons in the human submucous plexus via 5-HT 3 receptors. Gastroenterology, 128: 1317–1326. Bhatnagar, S., Sun, L. M., Raber, J., Maren, S., Julius, D., & Dallman, M. F. (2004). Changes in anxiety-related behaviors and hypothalamic-pituitary-adrenal activity in mice lacking the 5-HT-3A receptor. Physiology and Behavior, 81, 545–555. Bhatnagar, S., Sun, L. M., Raber, J., Maren, S., Julius, D., & Dallman, M. F. (2004). Changes in anxiety-related behaviors and hypothalamic-pituitary-adrenal activity in mice lacking the 5-HT-3A receptor. Physiology and Behavior, 81, 545–555. Bhatnagar, S., Sun, L. M., Raber, J., Maren, S., Julius, D., & Dallman, M. F. (2004). Changes in anxiety-related behaviors and hypothalamic-pituitary-adrenal activity in mice lacking the 5-HT-3A receptor. Physiology and Behavior, 81, 545–555. Sengupta, A., Bocchio, M., Bannerman, D. M., Sharp, T., & Capogna, M. (2017). Control of Amygdala Circuits by 5-HT Neurons via 5-HT and Glutamate Cotransmission. The Journal of Neuroscience, 37, 1785– Sengupta, A., Bocchio, M., Bannerman, D. M., Sharp, T., & Capogna, M. (2017). Control of Amygdala Circuits by 5-HT Neurons via 5-HT and Glutamate Cotransmission. The Journal of Neuroscience, 37, 1785–1796. Smit-Rigter, L. A., Wadman, W. J., & van Hooft, J. A. (2010). Impaired Social Behavior in 5-HT3A Receptor Knockout Mice. Frontiers in Behavioral Neuroscience, 4, 169. Kondo, M., Nakamura, Y., Ishida, Y., Yamada, T., & Shimada, S. (2014). The 5-HT3A receptor is essential for fear extinction. Learning & Memory, 21, 1–4.
5-hydroxytryptamine receptor 3A	see above
LOC106574177	No info

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
2678	ctg7180001845450_3014_SAC	env,wild	ssa14	54777236	missense_variant	LOC106570060	c.1116C>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
353959	106570147	14:54640757:54785108	ctg7180001845450_3014_SAC	14.0	54690757.0	54735108.0	LOC106570147	protein PRRC2A-like	protein_coding
353967	106570060	14:54709947:54839921	ctg7180001845450_3014_SAC	14.0	54759947.0	54789921.0	LOC106570060	sialidase-1-like	protein_coding
353972	106570059	14:54747115:54863795	ctg7180001845450_3014_SAC	14.0	54797115.0	54813795.0	LOC106570059	transmembrane protein C9orf91 homolog isoform X1	protein_coding
353981	106570058	14:54764948:54879864	ctg7180001845450_3014_SAC	14.0	54814948.0	54829864.0	LOC106570058	proline-rich transmembrane protein 1-like isof...	protein_coding

	References
protein PRRC2A	No clear association, but some hits related to neuronal system: Wu, R., Li, A., Sun, B., Sun, J. G., Zhang, J., Zhang, T., … Yuan, Z. (2019). A novel m 6 A reader Prrc2a controls oligodendroglial specification and myelination. Cell Research, 29, 23–41. Romanov, R. A., Zeisel, A., Bakker, J., Girach, F., Hellysaz, A., Tomer, R., … Harkany, T. (2017). Molecular interrogation of hypothalamic organization reveals distinct dopamine neuronal subtypes. Nature Neuroscience, 20, 176–188. Sridhar, G. R., & Sanjana, N. S. N. (2016). Sleep, circadian dysrhythmia, obesity and diabetes. World Journal of Diabetes, 7, 515–522.
sialidase-1	Wielgat, P., Walesiuk, A., & Braszko, J. J. (2011). Effects of chronic stress and corticosterone on sialidase activity in the rat hippocampus. Behavioural Brain Research, 222, 363–367. Fiorilli, A., Venerando, B., Siniscalco, C., Monti, E., Bresciani, R., Caimi, L., … Tettamanti, G. (1989). Occurrence in Brain Lysosomes of a Sialidase Active on Ganglioside. Journal of Neurochemistry, 53, 672–680. Mehta, N. R., Lopez, P. H. H., Vyas, A. A., & Schnaar, R. L. (2007). Gangliosides and Nogo receptors independently mediate myelin-associated glycoprotein inhibition of neurite outgrowth in different nerve cells. Journal of Biological Chemistry, 282, 27875–27886. Calhan, O. Y., & Seyrantepe, V. (2017). Mice with Catalytically Inactive Cathepsin A Display Neurobehavioral Alterations. Behavioural Neurology, 2017, 4261873.
transmembrane protein C9orf91 homolog isoform X1	No clear association, but one possibly relevant hit: Palacios-Reyes, C., Espinosa, A., Contreras, A., Ordonez, R., Hidalgo-Miranda, A., Rubio-Gayasso, I., … I., P. (2013). Williams' neural stem cells: new model for insight into microRNA dysregulation. Frontiers in Bioscience, E5, 1057–1073.

proline-rich transmembrane protein 1 (Prrt1)	Kirk, L. M., Ti, S. W., Bishop, H. I., Orozco-Llamas, M., Pham, M., Trimmer, J. S., & Díaz, E. (2016). Distribution of the SynDIG4/proline-rich transmembrane protein 1 in rat brain. Journal of Comparative Neurology, 524, 2266–2280. Chen, N., Pandya, N. J., Koopmans, F., Castelo-Székelv, V., Van Der Schors, R. C., Smit, A. B., & Li, K. W. (2014). Interaction proteomics reveals brain region-specific AMPA receptor complexes. Journal of Proteome Research, 13, 5695–5706. Bowden, N. A., Scott, R. J., & Tooney, P. A. (2008). Altered gene expression in the superior temporal gyrus in schizophrenia. BMC Genomics, 9, 199. Matt, L., Kirk, L. M., Chenaux, G., Speca, D. J., Puhger, K. R., Pride, M. C., … Díaz, E. (2018). SynDIG4/Prrt1 Is Required for Excitatory Synapse Development and Plasticity Underlying Cognitive Function. Cell Reports, 22, 2246–2253. Eshraghi, A. A., Liu, G., Kay, S.-I. S., Eshraghi, R. S., Mittal, J., Moshiree, B., & Mittal, R. (2018). Epigenetics and Autism Spectrum Disorder: Is There a Correlation? Frontiers in Cellular Neuroscience, 12, 78. Schmitz, L. J. M., Klaassen, R. V., Ruiperez-Alonso, M., Zamri, A. E., Stroeder, J., Rao-Ruiz, P., … Spijker, S. (2017). The AMPA receptor-associated protein Shisa7 regulates hippocampal synaptic function and contextual memory. ELife, 6, e24192. Troyano-Rodriguez, E., Mann, S., Ullah, R., & Ahmad, M. (2019). PRRT1 regulates basal and plasticity-induced AMPA receptor trafficking. Molecular and Cellular Neuroscience, 98, 155–163. Chen, N., Pandya, N. J., Koopmans, F., Castelo-Székelv, V., Van Der Schors, R. C., Smit, A. B., & Li, K. W. (2014). Interaction proteomics reveals brain region-specific AMPA receptor complexes. Journal of Proteome Research, 13, 5695–5706.

Salmobreed

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
25311	ctg7180001851039_10290_SAC	Distribution-SNP	ssa09	55068124	intergenic_region	LOC106611576-LOC106611580	n.55068124T>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
215345	106611580	9:55026673:55131334	ctg7180001851039_10290_SAC	9.0	55076673.0	55081334.0	LOC106611580	tryptophan 2	3-dioxygenase A-like
215386	106611581	9:55048962:55380563	ctg7180001851039_10290_SAC	9.0	55098962.0	55330563.0	LOC106611581	teneurin-3-like isoform X7	protein_coding

Same as for Mowi.

	References
tryptophan 2,3-dioxygenase A	Breda, C., Sathyasaikumar, K. V, Idrissi, S. S., Notarangelo, F. M., Estranero, J. G., Moore, G. G., … Giorgini, F. (2016). Tryptophan-2,3-dioxygenase (TDO) inhibition ameliorates neurodegeneration by modulation of kynurenine pathway metabolites. PNAS, 113, 5435–5440. Kanai, M., Funakoshi, H., Takahashi, H., Hayakawa, T., Mizuno, S., Matsumoto, K., & Nakamura, T. (2009). Tryptophan 2,3-dioxygenase is a key modulator of physiological neurogenesis and anxiety-related behavior in mice. Molecular Brain, 2, 8. Stone, T. W., Stoy, N., & Darlington, L. G. (2013). An expanding range of targets for kynurenine metabolites of tryptophan. Trends in Pharmacological Sciences, 34, 136–143. Ohira, K., Hagihara, H., Toyama, K., Takao, K., Kanai, M., Funakoshi, H., … Miyakawa, T. (2010). Expression of tryptophan 2,3-dioxygenase in mature granule cells of the adult mouse dentate gyrus. Molecular Brain, 3, 26.
teneurin-3	Antinucci, P., Nikolaou, N., Meyer, M. P., & Hindges, R. (2013). Teneurin-3 specifies morphological and functional connectivity of retinal ganglion cells in the vertebrate visual system. Cell Reports, 5, 582–592. Kenzelmann, D., Chiquet-Ehrismann, R., & Tucker, R. P. (2007). Teneurins, a transmembrane protein family involved in cell communication during neuronal development. Cellular and Molecular Life Sciences, 64, 1452–1456. Mosca, T. J., Hong, W., Dani, V. S., Favaloro, V., & Luo, L. (2012). Trans-synaptic Teneurin signalling in neuromuscular synapse organization and target choice. Nature, 484, 237–241. Berns, D. S., DeNardo, L. A., Pederick, D. T., & Luo, L. (2018). Teneurin-3 controls topographic circuit assembly in the hippocampus. Nature, 554, 328–333.

	Hong, W., Mosca, T. J., & Luo, L. (2012). Teneurins instruct synaptic partner matching in an olfactory map. Nature, 484, 201–207.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
6326	ctg7180001878854_3628_SAG	functional	ssa09	102397307	missense_variant	LOC106612683	c.1630T>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
225691	100194580	9:102288552:102403219	ctg7180001878854_3628_SAG	9.0	102338552.0	102353219.0	LOC100194580	zgc:113149-like isoform X4	protein_coding	›
225712	106612530	9:102303493:102405437	ctg7180001878854_3628_SAG	9.0	102353493.0	102355437.0	LOC106612530	ras-related protein ORAB-1-like	protein_coding	›
225727	106612684	9:102306563:102432891	ctg7180001878854_3628_SAG	9.0	102356563.0	102382891.0	LOC106612684	mitochondrial import inner membrane translocas...	protein_coding	›
225752	106612683	9:102343386:102449409	ctg7180001878854_3628_SAG	9.0	102393386.0	102399409.0	LOC106612683	delta-like protein C	protein_coding	›
225777	100196093	9:102394588:102498304	ctg7180001878854_3628_SAG	9.0	102444588.0	102448304.0	chp2	calcineurin B homologous protein 2 isoform X1	protein_coding	›

	References
zgc:113149-like isoform X4	No clear association
ras-related protein ORAB-1	No clear association
mitochondrial import inner membrane translocase	No clear association, but may be related to olfaction
delta-like protein C	Ebnet, K. (2017). Junctional Adhesion Molecules (JAMs): Cell Adhesion Receptors With Pleiotropic Functions in Cell Physiology and Development. Physiological Reviews, 97, 1529–1554.
chp2	Ukarapong, S., Bao, Y., Perera, E. M., & Berkovitz, G. D. (2012). Megakaryocyte development is normal in mice with targeted disruption of Tescalcin. Experimental Cell Research, 318, 662–669. Winstein, E., Cui, X., & Simmons, P. (2011). GENOMIC EDITING OF NEURODEVELOPMENTAL GENESIN ANMALS. Patent Application Publication (10) Pub . No .: US 2011 / 0218172 A1. 1(61).

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
41794	ctg7180001364094_5295_SCT	Distribution-SNP	ssa21	2283284	intergenic_region	dach1-gpr18	n.2283284C>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	I
477143	106581635	21:1820057:2306744	ctg7180001364094_5295_SCT	21.0	1870057.0	2256744.0	dach1	dachshund homolog 1 isoform X1	protein_coding	:

	References
dach1	Castiglioni, V., Faedo, A., Onorati, M., Bocchi, V. D., Li, Z., Iennaco, R., … Cattaneo, E. (2019). Dynamic and cell-specific DACH1 expression in human neocortical and striatal development. Cerebral Cortex, 29, 2115–2124. Machon, O., van den Bout, C. J., Backman, M., Røsok, Ø., Caubit, X., Fromm, S. H., … Krauss, S. (2002). Forebrain-specific promoter/enhancer D6 derived from the mouse Dach1 gene controls expression in neural stem cells. Neuroscience, 112, 951–966. Heanue, T. A., Davis, R. J., Rowitch, D. H., Kispert, A., McMahon, A. P., Mardon, G., & Tabin, C. J. (2002). Dach1, a vertebrate homologue of Drosophila dachshund, is expressed in the developing eye and ear of both chick and mouse and is regulated independently of Pax and Eya genes. Mechanisms of Development, 111, 75–87. Purcell, P., Oliver, G., Mardon, G., Donner, A. L., & Maas, R. L. (2005). Pax6-dependence of Six3, Eya1 and Dach1 expression during lens and nasal placode induction. Gene Expression Patterns, 6, 110–118. Colosimo, M. E., Brown, A., Mukhopadhyay, S., Gabel, C., Lanjuin, A. E., Samuel, A. D. T., & Sengupta, P. (2004). Identification of Thermosensory and Olfactory Neuron-Specific Genes via Expression Profiling of Single Neuron Types. Current Biology, 14, 2245–2251.
GPR18	McHugh, D. (2012). GPR18 in microglia: Implications for the CNS and endocannabinoid system signalling. British Journal of Pharmacology, 167, 1575–1582. Kanageswaran, N., Demond, M., Nagel, M., Schreiner, B. S. P., Baumgart, S., Scholz, P., … Gisselmann, G. (2015). Deep sequencing of the murine olfactory receptor neuron transcriptome. PLoS ONE, 10, e0113170. Penumarti, A., & Abdel-Rahman, A. A. (2014). The Novel Endocannabinoid Receptor GPR18 Is Expressed in the Rostral Ventrolateral Medulla and Exerts Tonic Restraining Influence on Blood Pressure. Journal of Pharmacology and Experimental Therapeutics, 349, 29–38. McHugh, D., Roskowski, D., Xie, S., & Bradshaw, H. B. (2014). Δ9-THC and N-arachidonoyl glycine regulate BV-2 microglial morphology and cytokine release plasticity: Implications for signaling at GPR18. Frontiers in Pharmacology, 4, 162.

	Luongo, L., Maione, S., & Di Marzo, V. (2014). Endocannabinoids and neuropathic pain: Focus on neuron-glia and endocannabinoid-neurotrophin interactions. European Journal of Neuroscience, 39, 401–408. Reyes-Resina, I., Navarro, G., Aguinaga, D., Canela, E. I., Schoeder, C. T., Załuski, M., … Franco, R. (2018). Molecular and functional interaction between GPR18 and cannabinoid CB2 G-protein-coupled receptors. Relevance in neurodegenerative diseases. Biochemical Pharmacology, 157, 169–179. Ramírez-Orozoco, R. E., García-Ruiz, R., Morales, P., Villalón, C. M., Villafán-Bernal, J. R., & Marichal-Cancino, B. A. (2019). Potential metabolic and behavioural roles of the putative endocannabinoid receptors GPR18, GPR55 and GPR119 in feeding. Curr. Neuropharmacol., Epub Ahead of Print. Burokas, A. (2013). New Behavioural Models to Investigate Eating Disorders. PhD Thesis, Universitat Pompeu Fabra, Barcelona. Retrieved from http://hdl.handle.net/10803/126535

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
24625	ctg7180001903360_761_SAC	Distribution-SNP	ssa08	26237329	intron_variant	melk	c.-25+32T>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
202802	106610568	8:26139111:26240634	ctg7180001903360_761_SAC	8.0	26189111.0	26190634.0	LOC106610568	histidine-rich glycoprotein-like	protein_coding
202806	106610569	8:26179057:26287526	ctg7180001903360_761_SAC	8.0	26229057.0	26237526.0	melk	maternal embryonic leucine zipper kinase	protein_coding

	References
histidine-rich glycoprotein	No clear association, probably immunology.
maternal embryonic leucine zipper kinase	Fike, J. R., Rosi, S., & Limoli, C. L. (2009). Neural Precursor Cells and Central Nervous System Radiation Sensitivity. Seminars in Radiation Oncology, 19, 122–132. Nakano, I., Masterman-Smith, M., Saigusa, K., Paucar, A. A., Horvath, S., Shoemaker, L., … Kornblum, H. I. (2008). Maternal embryonic leucine zipper kinase is a key regulator of the proliferation of malignant brain tumors, including brain tumor stem cells. Journal of Neuroscience Research, 86, 48–60.

	Jiang, P., & Zhang, D. (2013). Maternal embryonic leucine zipper kinase (MELK): A novel regulator in cell cycle control, embryonic development, and cancer. International Journal of Molecular Sciences, 14, 21551–21560. Nakano, I., Paucar, A. A., Bajpai, R., Dougherty, J. D., Zewail, A., Kelly, T. K., … Kornblum, H. I. (2005). Maternal embryonic leucine zipper kinase (MELK) regulates multipotent neural progenitor proliferation. Journal of Cell Biology, 170, 413–427.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
7431	ctg7180001591304_4622_SGT	functional	ssa14	34030280	missense_variant	LOC106569383	c.580C>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	P
350113	106569394	14:33942803:34046266	ctg7180001591304_4622_SGT	14.0	33992803.0	33996266.0	LOC106569394	zinc finger protein 333-like	protein_coding	X
350134	106569382	14:33954230:34079291	ctg7180001591304_4622_SGT	14.0	34004230.0	34029291.0	tep1	telomerase protein component 1	protein_coding	X
350145	106569383	14:33979334:34081305	ctg7180001591304_4622_SGT	14.0	34029334.0	34031305.0	LOC106569383	zinc finger protein 233-like	protein_coding	X
350153	106569381	14:33997947:34102341	ctg7180001591304_4622_SGT	14.0	34047947.0	34052341.0	LOC106569381	zinc finger protein 436-like isoform X2	protein_coding	X
350170	106569380	14:34002462:34112753	ctg7180001591304_4622_SGT	14.0	34052462.0	34062753.0	LOC106569380	nectin-4-like	protein_coding	X
350180	106569423	14:34027812:34130055	ctg7180001591304_4622_SGT	14.0	34077812.0	34080055.0	LOC106569423	high affinity immunoglobulin epsilon receptor ...	protein_coding	X

Same as for both Rauma and Mowi

	References
zinc finger protein 333	No clear association, probably immunology
telomerase protein component 1	No clear association
zinc finger protein 233	No clear association
zinc finger protein 436	Obayashi, S., Tabunoki, H., Kim, S. U., & Satoh, J. I. (2009). Gene expression profiling of human neural progenitor cells following the serum-induced astrocyte differentiation. Cellular and Molecular Neurobiology, 29, 423–438.
nectin-4	Mizoguchi, A., Nakanishi, H., Kimura, K., Matsubara, K., Ozaki-Kuroda, K., Katata, T., … Takai, Y. (2002). Nectin: An adhesion molecule involved in formation of synapses. Journal of Cell Biology, 156, 555–565. Lim, S. T., Lim, K.-C., Giuliano, R. E., & Federoff, H. J. (2008). Temporal and Spatial Localization of Nectin-1 and l-Afadin during Synaptogenesis in Hippocampal Neurons. The Journal of Comparative Neurology, 507, 1228–1244. Takai, Y., & Nakanishi, H. (2003). Nectin and afadin: novel organizers of intercellular junctions. Journal of Cell Science, 116, 17–27.

	Ogita, H., & Takai, Y. (2006). Nectins and nectin-like molecules: Roles in cell adhesion, polarization, movement, and proliferation. IUBMB Life, 58, 334–343. Katsunuma, S., Honda, H., Shinoda, T., Ishimoto, Y., Miyata, T., Kiyonari, H., … Togashi, H. (2016). Synergistic action of nectins and cadherins generates the mosaic cellular pattern of the olfactory epithelium. Journal of Cell Biology, 212, 561–575.
high affinity immunoglobulin epsilon receptor	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
18970	ctg7180001631827_192_SAC	Distribution-SNP	ssa03	56012380	intron_variant	gbgt1	c.68+24842G>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
83764	100194757	3:55915832:56087519	ctg7180001631827_192_SAC	3.0	55965832.0	56037519.0	gbgt1	globoside alpha-1	3-N-acetylgalactosaminyltransferase 1 isoform X2
83773	106600864	3:55974738:56075461	ctg7180001631827_192_SAC	3.0	56024738.0	56025461.0	LOC106600864	globoside alpha-1	3-N-acetylgalactosaminyltransferase 1-like
83782	106600863	3:56012132:56148043	ctg7180001631827_192_SAC	3.0	56062132.0	56098043.0	LOC106600863	integrin alpha-3-like isoform X1	protein_coding

Same as for Mowi.

	References
gbgt1	No clear association
LOC106600664 – globoside alpha-1	No clear association
integrin alpha-3	Huang, A.-M., Wang, H. L., Tang, Y. P., & Lee, E. H. Y. (1998). Expression of Integrin-Associated Protein Gene Associated with Memory Formation in Rats. The Journal of Neuroscience, 18, 4305–4313. Clegg, D. O., Wingerd, K. L., Hikita, S. T., & Tolhurst, E. C. (2003). Integrins in the development, function and dysfunction of the nervous system. [Frontiers in Bioscience, 8, d723-750. Stipp, C. S., & Hemler, M. E. (2000). Transmembrane-4-superfamily proteins CD151 and CD81 associate with α3β1 integrin, and selectively contribute to α3β1-dependent neurite outgrowth. Journal of Cell Science, 113, 1871–1882. Chang, H. P., Lindberg, F. P., Wang, H. L., Huang, A. M., & Lee, E. H. Y. (1999). Impaired memory retention and decreased long-term potentiation in integrin-associated protein-deficient mice. Learning and Memory, 6, 448–457.

	Stanco, A., Szekeres, C., Patel, N., Rao, S., Campbell, K., Kreidberg, J. A., … Anton, E. S. (2009). Netrin-1– α3β1 integrin interactions regulate the migration of interneurons through the cortical marginal zone. PNAS, 106, 7595–7600.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
34972	ctg7180001208887_1776_SCT	Distribution-SNP	ssa15	46306150	intron_variant	LOC106571584	c.1969+34T>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	P
376046	106571585	15:46112583:46308125	ctg7180001208887_1776_SCT	15.0	46162583.0	46258125.0	LOC106571585	serine/threonine-protein kinase MRCK alpha-lik...	protein_coding	X
376049	106571598	15:46208825:46313660	ctg7180001208887_1776_SCT	15.0	46258825.0	46263660.0	LOC106571598	left-right determination factor 2-like	protein_coding	X
376069	106571586	15:46216717:46326658	ctg7180001208887_1776_SCT	15.0	46266717.0	46276658.0	LOC106571586	heterogeneous nuclear ribonucleoprotein U-like	protein_coding	X
376086	106571584	15:46234816:46369550	ctg7180001208887_1776_SCT	15.0	46284816.0	46319550.0	LOC106571584	kinesin-like protein KIF26B	protein_coding	X
376094	106571597	15:46272414:46392783	ctg7180001208887_1776_SCT	15.0	46322414.0	46342783.0	LOC106571597	consortin-like	protein_coding	X
376104	106571596	15:46292942:46403873	ctg7180001208887_1776_SCT	15.0	46342942.0	46353873.0	LOC106571596	saccharopine dehydrogenase-like oxidoreductase	protein_coding	X

	References
serine/threonine-protein kinase MRCK alpha	No clear association
left-right determination factor 2	No clear association
heterogeneous nuclear ribonucleoprotein U	Liu, Q., & Dreyfuss, G. (1996). A novel nuclear structure containing the survival of motor neurons protein. The EMBO Journal, 15, 3555–3565. Taniura, H., & Yoshikawa, K. (2002). Necdin interacts with the ribonucleoprotein hnRNP U in the nuclear matrix. Journal of Cellular Biochemistry, 84, 545–555. Xiao, R., Tang, P., Yang, B., Huang, J., Zhou, Y., Shao, C., … Fu, X. D. (2012). Nuclear Matrix Factor hnRNP U/SAF-A Exerts a Global Control of Alternative Splicing by Regulating U2 snRNP Maturation. Molecular Cell, 45, 656–668. Liu, P., Wang, S. J., Wang, Z.-W., & Chen, B. (2018). HRPU-2, a Homolog of Mammalian hnRNP U, Regulates Synaptic Transmission by Controlling the Expression of SLO-2 Potassium Channel in Caenorhabditis elegans. The Journal of Neuroscience, 38, 1073–1084. Poot, M. (2019). HNRNPU: Key to Neurodevelopmental Disorders such as Intellectual Delay, Epilepsy, and Autism. Molecular Syndromology, 9, 275–278.

	Ticozzi, N., Ratti, A., & Silani, V. (2010). Protein Aggregation and Defective RNA Metabolism as Mechanisms for Motor Neuron Damage. CNS 6 Neurological Disorders - Drug Targets, 9, 285–296.
kinesin-like protein KIF26B	No clear association
consortin	Chabrat, A., Lacassagne, E., Billiras, R., Landron, S., Pontisso-Mahout, A., Darville, H., … Mannoury la Cour, C. (2019). Pharmacological Transdifferentiation of Human Nasal Olfactory Stem Cells into Dopaminergic Neurons. Stem Cells International, 2019, 2945435. Chabrat, A., Lacassagne, E., Billiras, R., Landron, S., Pontisso-Mahout, A., Darville, H., … Mannoury la Cour, C. (2019). Pharmacological Transdifferentiation of Human Nasal Olfactory Stem Cells into Dopaminergic Neurons. Stem Cells International, 2019, 2945435.
saccharopine dehydrogenase-like oxidoreductase	No clear association.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
33706	ctg7180001937818_13928_SAG	Distribution-SNP	ssa14	59744977	intron_variant	LOC106569936	c.1180+54T>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
355840	106569937	14:59640254:59745475	ctg7180001937818_13928_SAG	14.0	59690254.0	59695475.0	LOC106569937	LIM/homeobox protein Lhx9-like	protein_coding	X
355844	106569938	14:59648588:59774522	ctg7180001937818_13928_SAG	14.0	59698588.0	59724522.0	LOC106569938	H-2 class I histocompatibility antigen	Q10 alpha chain-like	
355849	106569936	14:59685521:59808313	ctg7180001937818_13928_SAG	14.0	59735521.0	59758313.0	LOC106569936	H-2 class I histocompatibility antigen	Q10 alpha chain-like isoform X1	
355858	106569935	14:59717932:59829224	ctg7180001937818_13928_SAG	14.0	59767932.0	59779224.0	LOC106569935	major histocompatibility complex class I-relat...	protein_coding	X
355870	106569933	14:59744364:59852214	ctg7180001937818_13928_SAG	14.0	59794364.0	59802214.0	LOC106569933	zinc finger and SCAN domain-containing protein...	protein_coding	X
611338	106569941	14:59659212:59767016	ctg7180001937818_13928_SAG	NaN	59709212.0	59717016.0	LOC106569941	NaN	lncRNA	

	References
LIM/homeobox protein Lhx9	Peukert, D., Weber, S., Lumsden, A., & Scholpp, S. (2011). Lhx2 and Lhx9 determine neuronal differentiation and compartition in the caudal forebrain by regulating Wnt signaling. PLoS Biology, 9, e1001218. Bertuzzi, S., Porter, F. D., Pitts, A., Kumar, M., Agulnick, A., Wassif, C., & Westphal, H. (1999). Characterization of Lhx9, a novel LIM/homeobox gene expressed by the pioneer neurons in the mouse cerebral cortex. Mechanisms of Development, 80, 193–198. Liu, J., Merkle, F. T., Gandhi, A. V., Gagnon, J. A., Woods, I. G., Chiu, C. N., … Prober, D. A. (2015). Evolutionarily conserved regulation of hypocretin neuron specification by Lhx9. Development, 142, 1113–1124.

	Avraham, O., Hadas, Y., Vald, L., Zisman, S., Schejter, A., Visel, A., & Klar, A. (2009). Transcriptional control of axonal guidance and sorting in dorsal interneurons by the Lim-HD proteins Lhx9 and Lhx1. Neural Development, 4, 21. Alunni, A., Blin, M., Deschet, K., Bourrat, F., Vernier, P., & Rétaux, S. (2004). Cloning and developmental expression patterns of Dlx2, Lhx7 and Lhx9 in the medaka fish (Oryzias latipes). Mechanisms of Development, 121, 977–983. Miyasaka, N., Morimoto, K., Tsubokawa, T., Higashijima, S. -i., Okamoto, H., & Yoshihara, Y. (2009). From the Olfactory Bulb to Higher Brain Centers: Genetic Visualization of Secondary Olfactory Pathways in Zebrafish. The Journal of Neuroscience, 29, 4756–4767. Huilgol, D., & Tole, S. (2016). Cell migration in the developing rodent olfactory system. Cellular and Molecular Life Sciences, 73, 2467–2490. Abellán, A., Legaz, I., Vernier, B., Rétaux, S., & Medina, L. (2009). Olfactory and amygdalar structures of the chicken ventral pallium based on the combinatorial expression patterns of LIM and other developmental regulatory genes. Journal of Comparative Neurology, 516, 166–186.
H-2 class I histocompatibility antigen, Q10 alpha chain	No convincing association, but a couple of relevant hits: Tarakanov, A. O., & Fuxe, K. G. (2013). Integrin triplets of marine sponges in the murine and human MHCI-CD8 interface and in the interface of human neural receptor heteromers and subunits. SpringerPlus, 2, 128. Renthal, N. E., Guidry, P. A., Shanmuganad, S., Renthal, W., & Stroynowski, I. (2011). Isoforms of the nonclassical class I MHC antigen H2-Q5 are enriched in brain and encode Qdm peptide. Immunogenetics, 63, 57–64.
H-2 class I histocompatibility antigen, Q10 alpha chain	See above
major histocompatibility complex class I-related gene protein	No clear association
zinc finger and SCAN domain-containing protein 2	No clear association, but one possibly relevant hit: Koemans, T. S. (2018). Converging molecular networks affected in Kleefstra syndrome and related neurodevelopmental disorders. PhD Thesis, Radboud University Nijmegen.
LOC106569941	No info

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
18035	ctg7180001853207_6271_SAG	Distribution-SNP	ssa02	65620891	intron_variant	LOC106593154	c.2175-30411T>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Protein_product
64256	106593154	2:65529955:65843864	ctg7180001853207_6271_SAG	2.0	65579955.0	65793864.0	LOC106593154	myosin heavy chain	fast skeletal muscle-like	protein_coding
64258	106593163	2:65415647:65729867	ctg7180001853207_6271_SAG	2.0	65465647.0	65679867.0	LOC106593163	myosin heavy chain	fast skeletal muscle-like isoform X1	protein_coding

	References
myosin heavy chain, fast skeletal muscle	No clear association
myosin heavy chain, fast skeletal muscle	No clear association, with regard to neuronal, olfactory etc. But: Pandya, K., & Smithies, O. (2011). β-MyHC and cardiac hypertrophy: Size does matter. Circulation Research, 109, 609–610. Tajsharghi, H., & Oldfors, A. (2013). Desminopathies: Pathology and mechanisms. Acta Neuropathologica, 125, 3–18. Mariner, P. D., Luckey, S. W., Long, C. S., Sucharov, C. C., & Leinwand, L. A. (2005). Yin Yang 1 represses α-myosin heavy chain gene expression in pathologic cardiac hypertrophy. Biochemical and Biophysical Research Communications, 326, 79–86. Harrison, B. C., Roberts, C. R., Hood, D. B., Sweeney, M., Gould, J. M., Bush, E. W., & McKinsey, T. A. (2004). The CRM1 Nuclear Export Receptor Controls Pathological Cardiac Gene Expression. Molecular and Cellular Biology, 24, 10636–10649. Schoser, B. G. H., Schneider-Gold, C., Kress, W., Goebel, H.-H., Reilich, P., Koch, M. C., … Ricker, K. (2004). Muscle pathology in 57 patients with myotonic dystrophy type 2. Muscle Nerve, 29, 275–281.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
6396	ctg7180001668257_1374_SAG	functional	ssa09	127219319	missense_variant	LOC106613166	c.142C>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
234167	106613174	9:127120919:127221760	ctg7180001668257_1374_SAG	9.0	127170919.0	127171760.0	LOC106613174	uncharacterized protein LOC106613174	protein_coding
234177	106613164	9:127129750:127255263	ctg7180001668257_1374_SAG	9.0	127179750.0	127205263.0	LOC106613164	ephexin-1-like isoform X2	protein_coding
234180	106613165	9:127157654:127268389	ctg7180001668257_1374_SAG	9.0	127207654.0	127218389.0	LOC106613165	lysophosphatidic acid receptor 6-like	protein_coding
234193	106613166	9:127169154:127271067	ctg7180001668257_1374_SAG	9.0	127219154.0	127221067.0	LOC106613166	lysophosphatidic acid receptor 4-like	protein_coding
234202	106613167	9:127171281:127276887	ctg7180001668257_1374_SAG	9.0	127221281.0	127226887.0	LOC106613167	integral membrane protein 2C-like	protein_coding
234213	106613169	9:127177173:127289687	ctg7180001668257_1374_SAG	9.0	127227173.0	127239687.0	LOC106613169	calcium-binding protein 39	protein_coding
234224	106613159	9:127191600:127293904	ctg7180001668257_1374_SAG	9.0	127241600.0	127243904.0	LOC106613159	uncharacterized protein LOC106613159	protein_coding
234232	106613170	9:127203932:127306264	ctg7180001668257_1374_SAG	9.0	127253932.0	127256264.0	LOC106613170	transcription factor HES-1-like	protein_coding
234251	106613171	9:127209178:127310916	ctg7180001668257_1374_SAG	9.0	127259178.0	127260916.0	LOC106613171	transcription cofactor HES-6-like	protein_coding
234255	106613160	9:127214991:127321536	ctg7180001668257_1374_SAG	9.0	127264991.0	127271536.0	LOC106613160	uncharacterized protein LOC106613160	protein_coding
671675	106613158	9:127121760:127224319	ctg7180001668257_1374_SAG	NaN	NaN	NaN	NaN	NaN	NaN

	References
LOC106613174	No info
ephexin-1	Triplett, J. W., & Feldheim, D. A. (2012). Eph and ephrin signaling in the formation of topographic maps. Seminars in Cell and Developmental Biology, 23, 7–15. Klein, R. (2012). Eph/ephrin signalling during development. Development, 139, 4105–4109. Defourny, J., Poirrier, A. L., Lallemend, F., Sánchez, S. M., Neef, J., Vanderhaeghen, P., … Malgrange, B. (2013). Ephrin-A5/EphA4 signalling controls specific afferent targeting to cochlear hair cells. Nature Communications, 4, 1438. Anand, A., Tyagi, R., Mohanty, M., Goyal, M., Ranil D De Silva, K., & Wijekoon, N. (2015). Dystrophin induced cognitive impairment: Mechanisms, models and therapeutic strategies. Annals of Neurosciences, 22, 108–118. Beg, A. A., Sommer, J. E., Martin, J. H., & Scheiffele, P. (2007). α2-Chimaerin Is an Essential EphA4 Effector in the Assembly of Neuronal Locomotor Circuits. Neuron, 55, 768–778. Ng, Y. P., Wu, Z., Wise, H., Tsim, K. W. K., Wong, Y. H., & Ip, N. Y. (2009). Differential and synergistic effect of nerve growth factor and cAMP on the regulation of early response genes during neuronal differentiation. NeuroSignals, 17, 111–120.

	Berzat, A., & Hall, A. (2010). Cellular responses to extracellular guidance cues. The EMBO Journal, 29, 2734–2745. Kania, A., & Klein, R. (2016). Mechanisms of ephrin-Eph signalling in development, physiology and disease. Nature Reviews Molecular Cell Biology, 17, 240–256.
lysophosphatidic acid receptor 6	Related to the neuronal system, but ..
lysophosphatidic acid receptor 4	Yung, Y. C., Stoddard, N. C., Mirendil, H., & Chun, J. (2015). Lysophosphatidic Acid Signaling in the Nervous System. Neuron, 85, 669–682. Kremer, A. E., Gebhardt, L., Robering, J., Kühn, H., Wolf, K., & Fischer, M. M. J. (2019). Lysophosphatidic acid activates peripheral glial cells. Z Gastroenterol, 57, e46–e47. Furuta, D., Yamane, M., Tsujiuchi, T., Moriyama, R., & Fukushima, N. (2012). Lysophosphatidic acid induces neurite branch formation through LPA 3. Molecular and Cellular Neuroscience, 50, 21–34. Sheng, X., Yung, Y. C., Chen, A., & Chun, J. (2015). Lysophosphatidic acid signalling in development. Development, 142, 1390–1395. Lin, M. E., Rivera, R. R., & Chun, J. (2012). Targeted deletion of LPA5 identifies novel roles for lysophosphatidic acid signaling in development of neuropathic pain. Journal of Biological Chemistry, 287, 17608–17617. Robering, J. W., Gebhardt, L., Wolf, K., Kühn, H., Kremer, A. E., & Fischer, M. J. M. (2019). Lysophosphatidic acid activates satellite glia cells and Schwann cells. GLIA, 67, 999–1012. Geach, T. J., Faas, L., Devader, C., Gonzalez-Cordero, A., Tabler, J. M., Brunsdon, H., … Dale, L. (2014). An essential role for LPA signalling in telencephalon development. Development, 141, 940–949. Ingrassia, A., Dijkstra, A. A., Bochdanovits, Z., Drukarch, B., Voorn, P., Berendse, H. W., … van de Berg, W. D. J. (n.d.). Chapter 4: Transcriptome analysis of the olfactory bulb of aged individuals with Parkinson neuropathology. Retrieved from https://research.vu.nl/ws/portalfiles/portal/42128794/chapter+4.pdf Lee, S.-J., Tsao, K.-C., Cherng, B.-W., & Liao, Y.-H. (2015). Lysophospholipid receptor signaling in zebrafish development. Translational Cancer Research, 4, 544–556.
integral membrane protein 2C-like	Connected to the neuronal system, but no clear association
calcium-binding protein 39	No clear association

LOC106613159	No info
transcription factor HES-1	No clear association, but a few relevant hits: Jessen, U., Novitskaya, V., Walmod, P. S., Berezin, V., & Bock, E. (2003). Neural cell adhesion molecule-mediated neurite outgrowth is repressed by overexpression of HES-1. Journal of Neuroscience Research, 71, 1–6. Im, S. Y., & Moon, C. (2015). Transcriptional regulatory network during development in the olfactory epithelium. BMB Reports, 48, 599–608. Ristori, E., & Nicoli, S. (2017). Comparative Functions of miRNAs in Embryonic Neurogenesis and Neuronal Network Formation. In Essentials of Noncoding RNA in Neuroscience: Ontogenetics, Plasticity of the Vertebrate Brain (pp. 265–282). https://doi.org/10.1016/B978-0-12-804402-5.00015-7
transcription cofactor HES-6	No clear association, but inhibitor of HES 1
LOC106613160	No info

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
34861	ctg7180001827628_2639_SGT	Distribution-SNP	ssa15	38579942	intron_variant	LOC106571504	c.73+18029T>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
374183	106571498	15:38344217:38584145	ctg7180001827628_2639_SGT	15.0	38394217.0	38534145.0	LOC106571498	disheveled-associated activator of morphogenes...	protein_coding
374222	106571502	15:38482783:38588502	ctg7180001827628_2639_SGT	15.0	38532783.0	38538502.0	l3hypdh	trans-3-hydroxy-L-proline dehydratase isoform X1	protein_coding
374241	106571503	15:38491933:38597663	ctg7180001827628_2639_SGT	15.0	38541933.0	38547663.0	LOC106571503	potassium channel subfamily K member 1-like	protein_coding
374260	106571504	15:38511547:38754062	ctg7180001827628_2639_SGT	15.0	38561547.0	38704062.0	LOC106571504	potassium voltage-gated channel subfamily H me...	protein_coding

	References
disheveled-associated activator of morphogenesis 1	Salomon, S. N., Haber, M., Murai, K. K., & Dunn, R. J. (2008). Localization of the Diaphanous-related formin Daam1 to neuronal dendrites. Neuroscience Letters, 447, 62–67. Wagh, D., Terry-Lorenzo, R., Waites, C. L., Leal-Ortiz, S. A., Maas, C., Reimer, R. J., & Garner, C. C. (2015). Piccolo directs activity dependent F-actin assembly from presynaptic active zones via daam1. PLoS ONE, 10, e0120093.

	Kida, Y., Shiraishi, T., & Ogura, T. (2004). Identification of chick and mouse Daam1 and Daam2 genes and their expression patterns in the central nervous system. Developmental Brain Research, 153, 143–150. Luo, W., Lieu, Z. Z., Manser, E., Bershadsky, A. D., & Sheetz, M. P. (2016). Formin DAAM1 organizes actin filaments in the cytoplasmic nodal actin network. PLoS ONE, 11, e0163915. Kawabata Galbraith, K., Fujishima, K., Mizuno, H., Lee, S. J., Uemura, T., Sakimura, K., … Kengaku, M. (2018). MTSS1 Regulation of Actin-Nucleating Formin DAAM1 in Dendritic Filopodia Determines Final Dendritic Configuration of Purkinje Cells. Cell Reports, 24, 95–106. Wang, Q., Titlow, W. B., McClintock, D. A., Stromberg, A. J., & McClintock, T. S. (2017). Activity-dependent gene expression in the Mammalian olfactory epithelium. Chemical Senses, 42, 611–624.
l3hypdh	No clear association
potassium channel subfamily K member 1	No clear association(?)
potassium voltage-gated channel subfamily H member 5	No clear association, but: Jeong, S. G., Ohn, T., Kim, S. H., & Cho, G. W. (2013). Valproic acid promotes neuronal differentiation by induction of neuroprogenitors in human bone-marrow mesenchymal stromal cells. Neuroscience Letters, 554, 22–27.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
32574	ctg7180001827868_2803_SAC	Distribution-SNP	ssa13	90658249	intron_variant	LOC106568138	n.234+7483G>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
333958	106568136	13:90625721:90740231	ctg7180001827868_2803_SAC	13.0	90675721.0	90690231.0	LOC106568136	serine/threonine-protein phosphatase 2B cataly...	protein_coding	X
333966	106568137	13:90627100:90730983	ctg7180001827868_2803_SAC	13.0	90677100.0	90680983.0	LOC106568137	uncharacterized protein LOC106568137 isoform X2	protein_coding	X
333969	106568134	13:90643642:90773901	ctg7180001827868_2803_SAC	13.0	90693642.0	90723901.0	LOC106568134	dematin-like isoform X4	protein_coding	X
608187	106568138	13:90589436:90716870	ctg7180001827868_2803_SAC	NaN	90639436.0	90666870.0	LOC106568138	NaN	lncRNA	

	References
serine/threonine-protein phosphatase 2B catalytic subunit gamma isoform (PPP3CC)	Sarnay, Z. and Guest, P. C. Connecting brain proteomics with behavioural neuroscience in translational animal models of neuropsychiatric disorders. In Guest, P. C. (2017). Proteomic Methods in Neuropsychiatric Research (P. C. Guest, ed.). Springer International Publishing AG 2017. Wesseling, H., Xu, B., Want, E. J., Holmes, E., Guest, P. C., Karayiorgou, M., … Bahn, S. (2017). System-based proteomic and metabonomic

	analysis of the Df(16)A+/- mouse identifies potential miR-185 targets and molecular pathway alterations. Molecular Psychiatry, 22, 384–395. Kautzky, A., Baldinger, P., Souery, D., Montgomery, S., Mendlewicz, J., Zohar, J., … Kasper, S. (2015). The combined effect of genetic polymorphisms and clinical parameters on treatment outcome in treatment-resistant depression. European Neuropsychopharmacology, 25, 441–453. Gerber, D. J., Hall, D., Miyakawa, T., Demars, S., Gogos, J. A., Karayiorgou, M., & Tonegawa, S. (2003). Evidence for association of schizophrenia with genetic variation in the 8p21.3 gene, PPP3CC, encoding the calcineurin gamma subunit. Proceedings of the National Academy of Sciences, 100, 8993–8998. Mathieu, F., Miot, S., Etain, B., El Khoury, M. A., Chevalier, F., Bellivier, F., … Tzavara, E. T. (2008). Association between the PPP3CC gene, coding for the calcineurin gamma catalytic subunit, and bipolar disorder. Behavioral and Brain Functions, 4, 2. Ambrozkiewicz, M. C., Ripamonti, S., Borisova, E., & Schwark, M. (2019). The Kaufman oculocerebrofacial syndrome protein Ube3b regulates synapse number by ubiquitinating Ppp3cc. BioRxiv, http://dx.doi.org/10.1101/672923 Hammond, D. R., & Udvadia, A. J. (2010). Cabin1 expression suggests roles in neuronal development. Developmental Dynamics, 239, 2443–2451. Lee, J. Il, & Ahnn, J. (2004). Calcineurin in animal behavior. Molecules and Cells, 17, 390–396. Collier, D. A., & Li, T. (2003). The genetics of schizophrenia: Glutamate not dopamine? European Journal of Pharmacology, 480, 177–184.
LOC106568137	No info
dematin	No clear association, but one hit related to brain expression: Schnack, C., Danzer, K. M., Hengerer, B., & Gillardon, F. (2008). Protein array analysis of oligomerization-induced changes in alpha-synuclein protein-protein interactions points to an interference with Cdc42 effector proteins. Neuroscience, 154, 1450–1457.
LOC106568138	No info

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
43412	ctg7180001474449_216_SGT	Distribution-SNP	ssa22	48503098	upstream_gene_variant	LOC106583629	c.-170840A>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
502212	106583629	22:48202819:48550517	ctg7180001474449_216_SGT	22.0	48252819.0	48500517.0	LOC106583629	plexin-B1-like isoform X2	protein_coding
502216	100136508	22:48494612:48599738	ctg7180001474449_216_SGT	22.0	48544612.0	48549738.0	LOC100136508	ubiquitin-conjugating enzyme E2 variant 1-like	protein_coding

	References
plexin-B1	Swiercz, J. M., Kuner, R., Behrens, J., & Offermanns, S. (2002). Plexin-B1 directly interacts with PDZ-RhoGEF/LARG to regulate RhoA and growth cone morphology. Neuron, 35, 51–63. Oinuma, I., Katoh, H., & Neigishi, M. (2004). Molecular Dissection of the Semaphorin 4D Receptor Plexin-B1-Stimulated R-Ras GTPase-Activating Protein Activity and Neurite Remodeling in Hippocampal Neurons. Journal of Neuroscience, 24, 11473–11480. Aurandt, J., Vikis, H. G., Gutkind, J. S., Ahn, N., & Guan, K.-L. (2002). The semaphorin receptor plexin-B1 signals through a direct interaction with the Rho-specific nucleotide exchange factor, LARG. Proceedings of the National Academy of Sciences, 99, 12085–12090. Saito, Y., Oinuma, I., Fujimoto, S., & Negishi, M. (2009). Plexin-B1 is a GTPase activating protein for M-Ras, remodelling dendrite morphology. EMBO Reports, 10, 614–621. Lin, X., Ogiya, M., Takahara, M., Yamaguchi, W., Furuyama, T., Tanaka, H., … Inagaki, S. (2007). Sema4D-plexin-B1 implicated in regulation of dendritic spine density through RhoA/ROCK pathway. Neuroscience Letters, 428, 1–6.
ubiquitin-conjugating enzyme E2 variant 1	No clear association

Rauma

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
37679	ctg7180001825403_10894_SAG	Distribution-SNP	ssa17	27027265	intergenic_region	LOC106575831-LOC106575832	n.27027265G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
415529	106575832	17:27007867:27111372	ctg7180001825403_10894_SAG	17.0	27057867.0	27061372.0	LOC106575832	serine/threonine-protein kinase 24-like	protein_coding	X
415539	106575833	17:27026815:27133882	ctg7180001825403_10894_SAG	17.0	27076815.0	27083882.0	LOC106575833	R3H domain-containing protein 1-like	protein_coding	X

	References
serine/threonine-protein kinase 24	No clear association
R3H domain-containing protein 1	Ching, A.-S., & Ahmad-Annuar, A. (2015). A Perspective on the Role of microRNA-128 Regulation in Mental and Behavioral Disorders. Frontiers in Cellular Neuroscience, 9, 465. Franzoni, E., Booker, S. A., Parthasarathy, S., Rehfeld, F., Grosser, S., Srivatsa, S., … Wulczyn, F. G. (2015). miR-128 regulates neuronal migration, outgrowth and intrinsic excitability via the intellectual disability gene Phf6. ELife, 4, e04263. Hook, P. W., McClymont, S. A., Cannon, G. H., Law, W. D., Morton, A. J., Goff, L. A., & McCallion, A. S. (2018). Single-Cell RNA-Seq of Mouse Dopaminergic Neurons Informs Candidate Gene Selection for Sporadic Parkinson Disease. The American Journal of Human Genetics, 102, 427–446. Peebles, C. L. (2009). The Role of Arc in Regulating Spine Morphology and Neural Network Stability In Vivo. PhD Thesis, University of California, San Francisco. Retrieved from https://escholarship.org/uc/item/3p57f9fz Lanz, T. A., Guilmette, E., Gosink, M. M., Fischer, J. E., Fitzgerald, L. W., Stephenson, D. T., & Pletcher, M. (2013). Transcriptomic analysis of genetically defined autism candidate genes reveals common mechanisms of action. Molecular Autism, 4, 45. Bondar, N., Bryzgalov, L., Ershov, N., Gusev, F., Reshetnikov, V., Avgustinovich, D., … Merkulova, T. (2018). Molecular Adaptations to Social Defeat Stress and Induced Depression in Mice. Molecular Neurobiology, 55, 3394–3407.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
40474	ctg7180001850393_8798_SCT	Distribution-SNP	ssa20	403615	upstream_gene_variant	LOC106579799	c.-774G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
456539	106579799	20:354265:456391	ctg7180001850393_8798_SCT	20.0	404265.0	406391.0	LOC106579799	somatostatin-1A	protein_coding	X

	References
somatostatin-1A	Lin, X., Otto, C. J., Cardenas, R., & Peter, R. E. (2000). Somatostatin family of peptides and its receptors in fish. Canadian Journal of Physiology and Pharmacology, 78, 1053–1066. Slagter, B. J., Kittilson, J. D., & Sheridan, M. A. (2004). Somatostatin receptor subtype 1 and subtype 2 mRNA expression is regulated by nutritional state in rainbow trout (Oncorhynchus mykiss). General and Comparative Endocrinology, 139, 236–244. Olias, G., Viollet, C., Kusserow, H., Epelbaum, J., & Meyerhof, W. (2004). Regulation and function of somatostatin receptors. Journal of Neurochemistry, 89, 1057–1091. Lin, X., Janovick, J. A., Brothers, S., Conn, P. M., & Peter, R. E. (1999). Molecular cloning and expression of two type one somatostatin receptors in goldfish brain. Endocrinology, 140, 5211–5219. Canosa, L. F., Cerdá-Reverter, J. M., & Peter, R. E. (2004). Brain mapping of three somatostatin encoding genes in the goldfish. Journal of Comparative Neurology, 474, 43–57.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
37722	ctg7180001900396_1652_SCT	Distribution-SNP	ssa17	29730369	intron_variant	LOC106575937	c.147+62T>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
415992	106575937	17:29677813:29785307	ctg7180001900396_1652_SCT	17.0	29727813.0	29735307.0	LOC106575937	C5a anaphylatoxin chemotactic receptor 1-like	protein_coding	X

	References
C5a anaphylatoxin chemotactic receptor 1	Nomaru, H., Sakumi, K., Katogi, A., Ohnishi, Y. N., Kajitani, K., Tsuchimoto, D., … Nakabeppu, Y. (2014). Fosb gene products contribute to excitotoxic microglial activation by regulating the expression of complement C5a receptors in microglia. GLIA, 62, 1284– Murgoci, A.-N., Mallah, K., Aboulouard, S., Lefebvre, C., Kobeissy, F., Fournier, I., … Salzet, M. (2019). The Brain Origin of Neonatal Microglia Determines 3 the Content of Exosomes and Biological Function. Preprints - Not Peer-Reviewed, https://doi.org/10.2139/ssrn.3188437

	Bajic, G., Degn, S. E., Thiel, S., & Andersen, G. R. (2015). Complement activation, regulation, and molecular basis for complement-related diseases. The EMBO Journal, 34, 2735–2757. Gerard, N. P., & Gerard, C. (1991). The chemotactic receptor for human C5a anaphylatoxin. Nature, 349, 614–617. Lacy, M., Jones, J., Whittemore, S. R., Haviland, D. L., Wetsel, R. A., & Barnum, S. R. (1995). Expression of the receptors for the C5a anaphylatoxin, interleukin-8 and FMLP by human astrocytes and microglia. Journal of Neuroimmunology, 61, 71–78. Mukherjee, P., & Pasinetti, G. M. (2000). The role of complement anaphylatoxin C5a in neurodegeneration: implications in Alzheimer's disease. Journal of Neuroimmunology, 105, 124–130. Osaka, H., McGinty, A., Höpken, U. E., Lu, B., Gerard, C., & Pasinetti, G. M. (1999). Expression of C5a receptor in mouse brain: Role in signal transduction and neurodegeneration. Neuroscience, 88, 1073–1082. Gerard, N. P., Bao, L., Xiao-Ping, H., Eddy, R. L., Shows, T. B., & Gerard, C. (1993). Human Chemotaxis Receptor Genes Cluster at 19q13.3–13.4. Characterization of the Human C5a Receptor Gene. Biochemistry, 32, 1243–1250. Tsu, R. C., Allen, R. A., & Wong, Y. H. (1995). Stimulation of type II adenylyl cyclase by chemoattractant formyl peptide and C5a receptors. Molecular Pharmacology, 47, 835–841.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
7431	ctg7180001591304_4622_SGT	functional	ssa14	34030280	missense_variant	LOC106569383	c.580C>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	P
350113	106569394	14:33942803:34046266	ctg7180001591304_4622_SGT	14.0	33992803.0	33996266.0	LOC106569394	zinc finger protein 333-like	protein_coding	X
350134	106569382	14:33954230:34079291	ctg7180001591304_4622_SGT	14.0	34004230.0	34029291.0	tep1	telomerase protein component 1	protein_coding	X
350145	106569383	14:33979334:34081305	ctg7180001591304_4622_SGT	14.0	34029334.0	34031305.0	LOC106569383	zinc finger protein 233-like	protein_coding	X
350153	106569381	14:33997947:34102341	ctg7180001591304_4622_SGT	14.0	34047947.0	34052341.0	LOC106569381	zinc finger protein 436-like isoform X2	protein_coding	X
350170	106569380	14:34002462:34112753	ctg7180001591304_4622_SGT	14.0	34052462.0	34062753.0	LOC106569380	nectin-4-like	protein_coding	X
350180	106569423	14:34027812:34130055	ctg7180001591304_4622_SGT	14.0	34077812.0	34080055.0	LOC106569423	high affinity immunoglobulin epsilon receptor ...	protein_coding	X

Same as for both SalmoBreed and Mowi.

	References
zinc finger protein 333	No clear association, probably immunology

telomerase protein component 1	No clear association
zinc finger protein 233	No clear association
zinc finger protein 436	Obayashi, S., Tabunoki, H., Kim, S. U., & Satoh, J. I. (2009). Gene expression profiling of human neural progenitor cells following the serum-induced astrocyte differentiation. Cellular and Molecular Neurobiology, 29, 423–438.
nectin-4	Mizoguchi, A., Nakanishi, H., Kimura, K., Matsubara, K., Ozaki-Kuroda, K., Katata, T., … Takai, Y. (2002). Nectin: An adhesion molecule involved in formation of synapses. Journal of Cell Biology, 156, 555–565. Lim, S. T., Lim, K.-C., Giuliano, R. E., & Federoff, H. J. (2008). Temporal and Spatial Localization of Nectin-1 and l-Afadin during Synaptogenesis in Hippocampal Neurons. The Journal of Comparative Neurology, 507, 1228–1244. Takai, Y., & Nakanishi, H. (2003). Nectin and afadin: novel organizers of intercellular junctions. Journal of Cell Science, 116, 17–27. Ogita, H., & Takai, Y. (2006). Nectins and nectin-like molecules: Roles in cell adhesion, polarization, movement, and proliferation. IUBMB Life, 58, 334–343. Katsunuma, S., Honda, H., Shinoda, T., Ishimoto, Y., Miyata, T., Kiyonari, H., … Togashi, H. (2016). Synergistic action of nectins and cadherins generates the mosaic cellular pattern of the olfactory epithelium. Journal of Cell Biology, 212, 561–575.
high affinity immunoglobulin epsilon receptor	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
21377	ctg7180001883233_10351	Distribution-SNP	ssa05	41056260	synonymous_variant	LOC106604953	c.1248T>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
134200	106604951	5:40924817:41089395	ctg7180001883233_10351	5.0	40974817.0	41039395.0	LOC106604951	histone-lysine N-methyltransferase 2D-like iso...	protein_coding	X
134209	106604953	5:40995740:41106883	ctg7180001883233_10351	5.0	41045740.0	41056883.0	LOC106604953	histone deacetylase 3	protein_coding	X
134227	106604954	5:41007857:41138484	ctg7180001883233_10351	5.0	41057857.0	41088484.0	LOC106604954	palladin-like	protein_coding	X
134233	100196367	5:41039181:41197755	ctg7180001883233_10351	5.0	41089181.0	41147755.0	LOC100196367	mitogen-activated protein kinase kinase kinase...	protein_coding	X

	References
histone-lysine N-methyltransferase 2D	Christianson, J., & D, J. O. P. (2017). The Role of Development in Kabuki Syndrome : A Review. Poster, https://Scholarworks.Boisestate.Edu/Cgi/Viewcontent.Cgi?Referer=https://Scholar.Google.Com/&httpsredir=1&article=1054&context=as_17

	Dong, C., Umar, M., Bartoletti, G., Gahankari, A., Fidelak, L., & He, F. (2019). Expression pattern of Kmt2d in murine craniofacial tissues. Gene Expression Patterns, 34, 119060. Vallianatos, C. N., & Iwase, S. (2015). Disrupted intricacy of histone H3K4 methylation in neurodevelopmental disorders. Epigenomics, 7, 503–519. Tekendo-Ngongang, C., Kruszka, P., Martinez, A. F., & Muenke, M. (2019). Novel heterozygous variants in KMT2D associated with holoprosencephaly. Clinical Genetics, 96, 266–270.
histone deacetylase 3	McQuown, S. C., Barrett, R. M., Matheos, D. P., Post, R. J., Rogge, G. A., Alenghat, T., … Wood, M. A. (2011). HDAC3 Is a Critical Negative Regulator of Long-Term Memory Formation. The Journal of Neuroscience, 31, 764–774. Nott, A., Cheng, J., Gao, F., Lin, Y. T., Gjoneska, E., Ko, T., … Tsai, L. H. (2016). Histone deacetylase 3 associates with MeCP2 to regulate FOXO and social behavior. Nature Neuroscience, 19, 1497–1505. Sahar, S., & Sassone-Corsi, P. (2012). Circadian rhythms and memory formation: regulation by chromatin remodeling. Frontiers in Molecular Neuroscience, 5, 37. Zhu, X., Wang, S., Yu, L., Jin, J., Ye, X., Liu, Y., & Xu, Y. (2017). HDAC3 negatively regulates spatial memory in a mouse model of Alzheimer's disease. Aging Cell, 16, 1073–1082.
Paladin	Boukhelifa, M., Hwang, S. J., Valtschanoff, J. G., Meeker, R. B., Rustioni, A., & Otey, C. A. (2003). A critical role for palladin in astrocyte morphology and response to injury. Molecular and Cellular Neuroscience, 23, 661–668. Hwang, S. J., Pagliardini, S., Boukhelifa, M., Parast, M. M., Otey, C. A., Rustioni, A., & Valtschanoff, J. G. (2001). Palladin is expressed preferentially in excitatory terminals in the rat central nervous system. Journal of Comparative Neurology, 436, 211–224. Boukhelifa, M., Parast, M. M., Valtschanoff, J. G., LaMantia, A. S., Meeker, R. B., & Otey, C. A. (2001). A Role for the Cytoskeleton-associated Protein Palladin in Neurite Outgrowth. Molecular Biology of the Cell, 12, 2721–2729. Luo, H., Liu, X., Wang, F., Huang, Q., Shen, S., Wang, L., … Wang, Z. (2005). Disruption of palladin results in neural tube closure defects in mice. Molecular and Cellular Neuroscience, 29, 507–515. Umegaki, Y., Brotons, A. M., Nakanishi, Y., Luo, Z., Zhang, H., Bonni, A., & Ikeuchi, Y. (2018). Palladin Is a Neuron-Specific Translational Target of mTOR Signaling That Regulates Axon Morphogenesis. The Journal of Neuroscience, 38, 4985–4995.
mitogen-activated protein kinase kinase	Traverse, S., Gomez, N., Paterson, H., Marshall, C., & Cohen, P. (1992). Sustained activation of the mitogen-activated protein (MAP) kinase cascade may be required for differentiation of PC12 cells. Comparison of the effects of nerve growth factor and epidermal growth factor. Biochemical Journal, 288, 351–355.

	Chi, H., Sarkisian, M. R., Rakic, P., & Flavell, R. A. (2005). Loss of mitogen-activated protein kinase kinase kinase 4 (MEKK4) results in enhanced apoptosis and defective neural tube development. PNAS, 102, 3846–3851. Davis, S., & Laroche, S. (2006). Mitogen-activated protein kinase / extracellular regulated kinase signalling and memory stabilization : a review. Genes, Brain and Behavior, 5, 61–72. Learish, R. D., Bruss, M. D., & Haak-frendscho, M. (2000). Inhibition of mitogen-activated protein kinase kinase blocks proliferation of neural progenitor cells. Developmental Brain Research, 122, 97–109.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
44228	ctg7180001809345_1074_SCT	Distribution-SNP	ssa23	36182565	upstream_gene_variant	LOC106584531	c.-5173G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
514064	100195695	23:36053225:36188764	ctg7180001809345_1074_SCT	23.0	36103225.0	36138764.0	urah	5-hydroxyisourate hydrolase	protein_coding	N
514078	106584530	23:36088860:36203079	ctg7180001809345_1074_SCT	23.0	36138860.0	36153079.0	LOC106584530	AFG3-like protein 1	protein_coding	X
514084	106584529	23:36102962:36310627	ctg7180001809345_1074_SCT	23.0	36152962.0	36260627.0	LOC106584529	voltage-dependent calcium channel subunit alph...	protein_coding	X
514118	106584531	23:36137419:36240741	ctg7180001809345_1074_SCT	23.0	36187419.0	36190741.0	LOC106584531	leucine-rich repeat and transmembrane domain-c...	protein_coding	X

Same as for Mowi.

	References
5-hydroxyisourate hydrolase	No clear association
AFG3-like protein 1	No clear association, but a few relevant hits: Rugarli, E. I., & Langer, T. (2012). Mitochondrial quality control: A matter of life and death for neurons. The EMBO Journal, 31, 1336–1349. Rugarli, E. I., & Langer, T. (2006). Translating m-AAA protease function in mitochondria to hereditary spastic paraplegia. Trends in Molecular Medicine, 12, 262–269. Ferreirinha, F., Pirozzi, M., Valsecchi, V., Broccoli, V., Auricchio, A., Ballabio, A., … Rugarli, E. I. (2004). Axonal degeneration in paraplegin-deficient mice is associated with abnormal mitochondria and impairment of axonal transport. Journal of Clinical Investigation, 113, 231–242. Tanner, A. J., & Dice, J. F. (1996). Batten Disease and mitochondrial pathways of proteolysis. Biochemical and Molecular Medicine, 57, 1–9.

	Nolden, M., Ehses, S., Koppen, M., Bernacchia, A., Rugarli, E. I., & Langer, T. (2005). The m-AAA protease defective in hereditary spastic paraplegia controls ribosome assembly in mitochondria. Cell, 123, 277–289. Burté, F., Carelli, V., Chinnery, P. F., & Yu-Wai-Man, P. (2015). Disturbed mitochondrial dynamics and neurodegenerative disorders. Nature Reviews Neurology, 11, 11–24.
voltage-dependent calcium channel subunit alpha	Hirasawa, M., Xu, X., Trask, R. B., Maddatu, T. P., Johnson, B. A., Naggert, J. K., … Ikeda, A. (2007). Carbonic anhydrase related protein 8 mutation results in aberrant synaptic morphology and excitatory synaptic function in the cerebellum. Mol. Cell. Neurosci., 35, 161–170.
leucine-rich repeat and transmembrane domain-c…	Sarria, I., Cao, Y., Wang, Y., Kefalov, V. J., Sampath, A. P., Martemyanov, K. A., … Kamasawa, N. (2018). LRIT1 Modulates Adaptive Changes in Synaptic Communication of Cone Photoreceptors. Cell Reports, 22, 3562–3573. Cobb, C. A. (2018). Functional and structural impact of the loss of the leucine-rich repeat protein LRIT1 in the mouse retina . Electronic Theses and Dissertations. Paper 2968. Retrieved from https://doi.org/10.18297/etd/2968 Winther M., Walmod P.S. (2014) Neural Cell Adhesion Molecules Belonging to the Family of Leucine-Rich Repeat Proteins. In: Berezin V., Walmod P. (eds) Cell Adhesion Molecules. Advances in Neurobiology, vol 8. Springer, New York, NY Ueno, A., Omori, Y., Sugita, Y., Watanabe, S., Chaya, T., Kozuka, T., … Furukawa, T. (2018). Lrit1, a Retinal Transmembrane Protein, Regulates Selective Synapse Formation in Cone Photoreceptor Cells and Visual Acuity. Cell Reports, 22, 3548–3561.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
23606	ctg7180001289769_2604_SCT	Distribution-SNP	ssa07	19281860	intron_variant	LOC106608718	c.-467-20101T>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
182498	106608718	7:19171509:19396231	ctg7180001289769_2604_SCT	7.0	19221509.0	19346231.0	LOC106608718	neuroligin-2-like isoform X2	protein_coding

	References
neuroligin-2-isoform X2	Gollan, L., & Sheiffele, P. (2006). Assembly of Synapses in the Vertebrate Central Nervous System In: Protein trafficking in neurons (A. J. Bean, ed.). Elsevier Science & Technology.

	Varoqueaux, F., Jamain, S., & Brose, N. (2004). Neuroligin 2 is exclusively localized to inhibitory synapses. European Journal of Cell Biology, 83, 449–456. Poulopoulos, A., Aramuni, G., Meyer, G., Soykan, T., Hoon, M., Papadopoulos, T., … Varoqueaux, F. (2009). Neuroligin 2 Drives Postsynaptic Assembly at Perisomatic Inhibitory Synapses through Gephyrin and Collybistin. Neuron, 63, 628–642. Blundell, J., Tabuchi, K., Bolliger, M. F., Blaiss, C. A., Brose, N., Liu, X., … Powell, C. M. (2009). Increased anxiety-like behavior in mice lacking the inhibitory synapse cell adhesion molecule neuroligin 2. Genes, Brain and Behavior, 8, 114–126. Hines, R. M., Wu, L., Hines, D. J., Steenland, H., Mansour, S., Dahlhaus, R., … El-Husseini, A. (2008). Synaptic Imbalance, Stereotypies, and Impaired Social Interactions in Mice with Altered Neuroligin 2 Expression. The Journal of Neuroscience, 28, 6055–6067.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
10958	ctg7180001787680_1094_SAC	WildSouth-Aqua	ssa09	17186275	downstream_gene_variant	LOC106610816	c.*4229G>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
207039	106610815	9:17076968:17197366	ctg7180001787680_1094_SAC	9.0	17126968.0	17147366.0	LOC106610815	serine/arginine repetitive matrix protein 1-li...	protein_coding	X
207072	106610816	9:17102483:17233987	ctg7180001787680_1094_SAC	9.0	17152483.0	17183987.0	LOC106610816	chloride intracellular channel protein 4	protein_coding	X
207115	106610744	9:17149952:17250514	ctg7180001787680_1094_SAC	9.0	17199952.0	17200514.0	LOC106610744	classical arabinogalactan protein 11-like	protein_coding	X
207130	106610745	9:17154118:17255030	ctg7180001787680_1094_SAC	9.0	17204118.0	17205030.0	LOC106610745	uncharacterized protein LOC106610745	partial	
207155	106610822	9:17154984:17256101	ctg7180001787680_1094_SAC	9.0	17204984.0	17206101.0	LOC106610822	uncharacterized protein LOC106610822	protein_coding	X
207175	106610817	9:17174098:17340780	ctg7180001787680_1094_SAC	9.0	17224098.0	17290780.0	LOC106610817	runt-related transcription factor 3-like isofo...	protein_coding	X

	References
serine/arginine repetitive matrix protein 1	Kim, Y. J., Kim, H., & Noh, K. (2014). Investigation on lipopolysaccharide activated microglia by phosphoproteomics and phosphoinositide lipidomics. Mass Spectrometry Letters, 5, 70–78.
chloride intracellular channel protein 4	Padmakumar, V., Masiuk, K. E., Luger, D., Lee, C., Coppola, V., Tessarollo, L., … Yuspa, S. H. (2014). Detection of differential fetal and adult expression of chloride intracellular channel 4 (CLIC4) protein by analysis of a green fluorescent protein knock-in mouse line. BMC Developmental Biology, 14, 24. Lucitti, J. L., Tarte, N. J., & Faber, J. E. (2015). Chloride intracellular channel 4 is required for maturation of the cerebral collateral

	circulation. American Journal of Physiology-Heart and Circulatory Physiology, 309, H1141–H1150. Suginta, W., Karoulias, N., Aitken, A., & Ashley, R. H. (2001). Chloride intracellular channel protein CLIC4 (p64H1) binds directly to brain dynamin I in a complex containing actin, tubulin and 14-3-3 isoforms. Biochem. J., 359, 55–64. Shukla, A., & Yuspa, S. H. (2010). CLIC4 and Schnurri-2: A dynamic duo in TGFβ signaling with broader implications in cellular homeostasis and disease. Nucleus, 1, 144–149. Maryoung, L. A., Blunt, B., Tierney, K. B., & Schlenk, D. (2015). Sublethal toxicity of chlorpyrifos to salmonid olfaction after hypersaline acclimation. Aquatic Toxicology, 161, 94–101. Waddell, B. (2016). CLIC5 maintains lifelong structural integrity of sensory stereocilia by promoting Radixin phosphorylation in hair cells of the inner ear. Thesis Bachelor of Science (BS), Ohio University, Biological Sciences, http://Rave.Ohiolink.Edu/Etdc/View?Acc_num=ouhonors1461332124
classical arabinogalactan protein 11	No clear association
runt-related transcription factor 3-like isofo..	Marmigère, F., & Ernfors, P. (2007). Specification and connectivity of neuronal subtypes in the sensory lineage. Nature Reviews Neuroscience, 8, 114–127.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
10959	ctg7180001628780_3092_SAG	WildSouth-Aqua	ssa09	17216431	intergenic_region	LOC106610822-LOC106610817	n.17216431G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
207062	106610816	9:17102483:17233987	ctg7180001628780_3092_SAG	9.0	17152483.0	17183987.0	LOC106610816	chloride intracellular channel protein 4	protein_coding	X
207102	106610744	9:17149952:17250514	ctg7180001628780_3092_SAG	9.0	17199952.0	17200514.0	LOC106610744	classical arabinogalactan protein 11-like	protein_coding	X
207119	106610745	9:17154118:17255030	ctg7180001628780_3092_SAG	9.0	17204118.0	17205030.0	LOC106610745	uncharacterized protein LOC106610745	partial	
207147	106610822	9:17154984:17256101	ctg7180001628780_3092_SAG	9.0	17204984.0	17206101.0	LOC106610822	uncharacterized protein LOC106610822	protein_coding	X
207162	106610817	9:17174098:17340780	ctg7180001628780_3092_SAG	9.0	17224098.0	17290780.0	LOC106610817	runt-related transcription factor 3-like isofo...	protein_coding	X

Closely linked to the panel above.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
23766	ctg7180001858455_7377_SAG	Distribution-SNP	ssa07	30522174	intron_variant	LOC100306760	c.764+238G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
186594	100306760	7:30446359:30624146	ctg7180001858455_7377_SAG	7.0	30496359.0	30574146.0	LOC100306760	ubiquitin carboxyl-terminal hydrolase 15 isofo...	protein_coding

	References
ubiquitin carboxyl-terminal hydrolase 15	Cheng, P. H., Li, C. L., Chang, Y. F., Tsai, S. J., Lai, Y. Y., Chan, A. W. S., … Yang, S. H. (2013). MiR-196a ameliorates phenotypes of huntington disease in cell, transgenic mouse, and induced pluripotent stem cell models. American Journal of Human Genetics, 93, 306–312. Filipović, D., Costina, V., Perić, I., Stanisavljević, A., & Findeisen, P. (2017). Chronic fluoxetine treatment directs energy metabolism towards the citric acid cycle and oxidative phosphorylation in rat hippocampal nonsynaptic mitochondria. Brain Research, 1659, 41–54. Chou, C. K., Chang, Y. T., Korinek, M., Chen, Y. T., Yang, Y. T., Leu, S., … Chiu, C. C. (2017). The regulations of deubiquitinase USP15 and its pathophysiological mechanisms in diseases. International Journal of Molecular Sciences, 18, 483.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
26059	ctg7180001552685_1089_SGT	Distribution-SNP	ssa09	108793201	intron_variant	ift80	c.859-3986C>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
228856	106612911	9:108704207:108806313	ctg7180001552685_1089_SGT	9.0	108754207.0	108756313.0	cssa09h3orf80	uncharacterized membrane protein C3orf80 homolog	protein_coding
228869	106612779	9:108730236:108896900	ctg7180001552685_1089_SGT	9.0	108780236.0	108846900.0	ift80	LOW QUALITY PROTEIN: intraflagellar transport ...	protein_coding
671260	106612912	9:108699451:108829988	ctg7180001552685_1089_SGT	NaN	108749451.0	108779988.0	LOC106612912	NaN	lncRNA

	References
ift80	Hudak, L. M., Lunt, S., Chang, C. H., Winkler, E., Flammer, H., Lindsey, M., & Perkins, B. D. (2010). The intraflagellar transport protein Ift80 is essential for photoreceptor survival in a zebrafish model of jeune asphyxiating thoracic dystrophy. Investigative Ophthalmology & Visual Science, 51, 3792–3799. Bogert, B. (2007). Genetic Analyses of the Development and Function of Sensory Neurons. PhD Thesis, University of California, San Francisco. Retrieved from https://escholarship.org/uc/item/9ff1276t Bizaoui, V., Huber, C., Kohaut, E., Roume, J., Bonnière, M., Attié-Bitach, T., & Cormier-Daire, V. (2019). Mutations in IFT80 cause SRPS

	Type IV. Report of two families and review. American Journal of Medical Genetics, Part A, 179A, 639–644. Heron, P. M., Stromberg, A. J., Breheny, P., & McClintock, T. S. (2013). Molecular events in the cell types of the olfactory epithelium during adult neurogenesis. Molecular Brain, 6, 49. Uytingco, C. R., Green, W. W., & Martens, J. R. (n.d.). Olfactory loss and dysfunction in ciliopathies: Molecular mechanisms and potential therapies. Current Medicinal Chemistry, E-Pub Ahead of Print. https://doi.org/110.1016/j.bbi.2017.04.008

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
27707	ctg7180001934773_3779_SCT	Distribution-SNP	ssa10	76986708	intron_variant	zfpm1	c.40+4170C>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
254516	106560885	10:76912069:77115517	ctg7180001934773_3779_SCT	10.0	76962069.0	77065517.0	zfpm1	zinc finger protein ZFPM1 isoform X2	protein_coding

	References
zinc finger protein ZFPM1 isoform X2	Lahti, L., Achim, K., & Partanen, J. (2013). Molecular regulation of GABAergic neuron differentiation and diversity in the developing midbrain. Acta Physiologica, 207, 616–627. Hwang, C. H., Simeone, A., Lai, E., & Wu, D. K. (2009). Foxg1 is required for proper separation and formation of sensory cristae during inner ear development. Developmental Dynamics, 238, 2725–2734. Yang, Y., Li, B., Zhang, X., Zhao, Q., & Lou, X. (2019). The zinc finger protein Zfpm1 modulates ventricular trabeculation through Neuregulin-ErbB signalling. Developmental Biology, 446, 142–150. Lahti, L., Haugas, M., Tikker, L., Airavaara, M., Voutilainen, M. H., Anttila, J., … Partanen, J. (2016). Differentiation and molecular heterogeneity of inhibitory and excitatory neurons associated with midbrain dopaminergic nuclei. Development, 143, 516–529. Goold, R., Hubank, M., Hunt, A., Holton, J., Menon, R. P., Revesz, T., … Matilla-Dueñas, A. (2007). Down-regulation of the dopamine receptor D2 in mice lacking ataxin 1. Human Molecular Genetics, 16, 2122–2134. Galazo, M. J., Emsley, J. G., & Macklis, J. D. (2016). Corticothalamic Projection Neuron Development beyond Subtype Specification: Fog2

	and Intersectional Controls Regulate Intraclass Neuronal Diversity. Neuron, 91, 90–106.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
37673	ctg7180001936744_2288_SCT	Distribution-SNP	ssa17	26667003	intergenic_region	LOC106575824-LOC106575825	n.26667003G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
415512	106575823	17:26565531:26692762	ctg7180001936744_2288_SCT	17.0	26615531.0	26642762.0	LOC106575823	microtubule-associated protein 2-like	protein_coding
415516	106575824	17:26595813:26702335	ctg7180001936744_2288_SCT	17.0	26645813.0	26652335.0	LOC106575824	protein unc-80 homolog	partial
415524	106575825	17:26666129:26784780	ctg7180001936744_2288_SCT	17.0	26716129.0	26734780.0	LOC106575825	DNA-binding protein SATB2-like isoform X1	protein_coding

	References
microtubule-associated protein 2	Viereck, C., Tucker, R., & Matus, A. (1989). The adult rat olfactory system expresses microtubule-associated proteins found in the developing brain. The Journal of Neuroscience, 9, 3547–3557. Johnson, G. V., & Jope, R. S. (1992). The role of microtubule-associated protein 2 (MAP-2) in neuronal growth, plasticity, and degeneration. J. Neurosci. Res., 33, 502–512. Bernhardt, R., & Matus, A. (1984). Light and electron microscopic studies of the distribution of microtubule-associated protein 2 in rat brain: a difference between dendritic and axonal cytoskeletons. J. Comp. Neurol., 226, 203–221. Tucker, R. P. (1990). The roles of microfilament-associated proteins, drebrins, in brain morphogenesis: A review. Brain Research Reviews, 15, 101–120. Rioux, L., Ruscheinsky, D., & Arnold, S. E. (2004). Microtubule-associated protein MAP2 expression in olfactory bulb in schizophrenia. Psychiatry Research, 128, 1–7. Sánchez, C., Díaz-Nido, J., & Avila, J. (2000). Phosphorylation of microtubule-associated protein 2 (MAP2) and its relevance for the regulation of the neuronal cytoskeleton function. Progress in Neurobiology, 61, 133–168.
unc-80	Yeh, E., Ng, S., Zhang, M., Bouhours, M., Wang, Y., Wang, M., … Zhen, M. (2008). A putative cation channel, NCA-1, and a novel protein, UNC-80, transmit neuronal activity in C. elegans. PLoS Biology, 6, e55. Chen, B., Liu, Q., Ge, Q., Xie, J., & Wang, Z. W. (2007). UNC-1 Regulates Gap Junctions Important to Locomotion in C. elegans. Current Biology, 17, 1334–1339.

	Lu, B., Su, Y., Das, S., Wang, H., Wang, Y., Liu, J., & Ren, D. (2009). Peptide neurotransmitters activate a cation channel complex of NALCN and UNC-80. Nature, 457, 741–744.
SATB2	Britanova, O., de Juan Romero, C., Cheung, A., Kwan, K. Y., Schwark, M., Gyorgy, A., … Tarabykin, V. (2008). Satb2 Is a Postmitotic Determinant for Upper-Layer Neuron Specification in the Neocortex. Neuron, 57, 378–392. Gyorgy, A. B., Szemes, M., De Juan Romero, C., Tarabykin, V., & Agoston, D. V. (2008). SATB2 interacts with chromatin-remodeling molecules in differentiating cortical neurons. European Journal of Neuroscience, 27, 865–873. Leone, D. P., Heavner, W. E., Ferenczi, E. A., Dobreva, G., Huguenard, J. R., Grosschedl, R., & McConnell, S. K. (2015). Satb2 regulates the differentiation of both callosal and subcerebral projection neurons in the developing cerebral cortex. Cerebral Cortex, 25, 3406–3419. Shimizu, T., & Hibi, M. (2009). Formation and patterning of the forebrain and olfactory system by zinc-finger genes Fezf1 and Fezf2. Development Growth and Differentiation, 51, 221–231. Diodato, A., Ruinart De Brimont, M., Yim, Y. S., Derian, N., Perrin, S., Pouch, J., … Fleischmann, A. (2016). Molecular signatures of neural connectivity in the olfactory cortex. Nature Communications, 7, 12238. Kawasawa, Y. I., Salzberg, A. C., Li, M., Šestan, N., Greer, C. A., & Imamura, F. (2016). RNA-seq analysis of developing olfactory bulb projection neurons. Molecular and Cellular Neuroscience, 74, 78–86. Amaniti, E. M., Kelman, A., Mason, J. O., & Theil, T. (2015). Cerebral cortex expression of Gli3 is required for normal development of the lateral olfactory tract. PLoS ONE, 10, e0141525.

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	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
47482	ctg7180001903803_1531_SCT	Distribution-SNP	ssa28	18550835	intron_variant	cdrt1	c.977-494C>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
580832	106589630	28:18482572:18610561	ctg7180001903803_1531_SCT	28.0	18532572.0	18560561.0	cdrt1	CMT1A duplicated region transcript 1 protein i...	protein_coding
580841	106589631	28:18511212:18616448	ctg7180001903803_1531_SCT	28.0	18561212.0	18566448.0	LOC106589631	histone-lysine N-methyltransferase PRDM9-like ...	protein_coding
580850	100380747	28:18516456:18644660	ctg7180001903803_1531_SCT	28.0	18566456.0	18594660.0	LOC100380747	neurabin-2	protein_coding
580869	106589634	28:18545759:18659443	ctg7180001903803_1531_SCT	28.0	18595759.0	18609443.0	LOC106589634	alpha-sarcoglycan-like isoform X1	protein_coding

	References
cdrt1	No clear association
PRDM9	No convincing association, but: Shulha, H. P., Crisci, J. L., Reshetov, D., Tushir, J. S., Cheung, I., Bharadwaj, R., … Akbarian, S. (2012). Human-Specific Histone Methylation Signatures at Transcription Start Sites in Prefrontal Neurons. PLoS Biology, 10, e1001427. Wu, H., Mathioudakis, N., Diagouraga, B., Dong, A., Dombrovski, L., Baudat, F., … Kadlec, J. (2013). Molecular Basis for the Regulation of the H3K4 Methyltransferase Activity of PRDM9. Cell Reports, 5, 13–20.
neurabin-2	Nakanishi, H., Obaishi, H., Satoh, A., Wada, M., Mandai, K., Satoh, K., … Takai, Y. (1997). Neurabin: A novel neural tissue-specific actin filament-binding protein involved in neurite formation. The Journal of Cell Biology, 139, 951–961. Stoneham, E. T., Sanders, E. M., Sanyal, M., & Dumas, T. C. (2010). Rules of engagement: Factors that regulate activity-dependent synaptic plasticity during neural network development. Biological Bulletin, 219, 81–99. Sarrouilhe, D., di Tommaso, A., Métayé, T., & Ladeveze, V. (2006). Spinophilin: from partners to functions. Biochimie, 88, 1099–1113. Li, K. W., Hornshaw, M. P., Van der Schors, R. C., Watson, R., Tate, S., Casetta, B., … Smit, A. B. (2004). Proteomics Analysis of Rat Brain Postsynaptic Density. Journal of Biological Chemistry, 279, 987–1002.
alpha-sarcoglycan	No convincing association: Xiao, J., & LeDoux, M. S. (2003). Cloning, developmental regulation and neural localization of rat ε-sarcoglycan. Molecular Brain Research, 119, 132–143.

	Cai, H., Erdman, R. A., Zweier, L., Chen, J., Shaw IV, J. H., Baylor, K. A., … Chan, Y. mo M. (2007). The sarcoglycan complex in Schwann cells and its role in myelin stability. Experimental Neurology, 205, 257–269. Satz, J. S., Ostendorf, A. P., Hou, S., Turner, A., Kusano, H., Lee, J. C., … Campbell, K. P. (2010). Distinct Functions of Glial and Neuronal Dystroglycan in the Developing and Adult Mouse Brain. The Journal of Neuroscience, 30, 14560–14572. Ozawa, E., Mizuno, Y., Hagiwara, Y., Sasaoka, T., & Yoshida, M. (2005). Molecular and cell biology of the sarcoglycan complex. Muscle and Nerve, 32, 563–576.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
46880	ctg7180001268296_4006_SCT	Distribution-SNP	ssa27	23010617	intron_variant	LOC106588773	c.-2557+9614G>A

Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
396397:23013179	ctg7180001268296_4006_SCT	27.0	22946397.0	22963179.0	LOC106588772	wiskott-Aldrich syndrome protein family member...	protein_coding
913564:23070328	ctg7180001268296_4006_SCT	27.0	22963564.0	23020328.0	LOC106588773	methyltransferase-like protein 24 isoform X3	protein_coding
970243:23070874	ctg7180001268296_4006_SCT	27.0	23020243.0	23020874.0	LOC106588774	uncharacterized histidine-rich protein DDB_G02...	protein_coding
971006:23117381	ctg7180001268296_4006_SCT	27.0	23021006.0	23067381.0	LOC106588724	AT-hook DNA-binding motif-containing protein 1...	protein_coding
922089:23023883	ctg7180001268296_4006_SCT	NaN	22972089.0	22973883.0	LOC106588775	NaN	lncRNA

	References
wiskott-Aldrich syndrome protein family	Tsuchiya, D., Kitamura, Y., Takata, K., Sugisaki, T., Taniguchi, T., Uemura, K., … Shimohama, S. (2006). Developmental expression of neural Wiskott-Aldrich syndrome protein (N-WASP) and WASP family verprolin-homologous protein (WAVE)-related proteins in postnatal rat cerebral cortex and hippocampus. Neuroscience Research, 56, 459–469. Nozumi, M., Nakagawa, H., Miki, H., Takenawa, T., & Miyamoto, S. (2003). Differential localization of WAVE isoforms in filopodia and lamellipodia of the neuronal growth cone. Journal of Cell Science, 116, 239–246. Ito, H., Morishita, R., Shinoda, T., Iwamoto, I., Sudo, K., Okamoto, K., & Nagata, K. (2010). Dysbindin-1, WAVE2 and Abi-1 form a complex that regulates dendritic spine formation. Molecular Psychiatry, 15, 976–986.

methyltransferase 24	No clear association
DDB_G02	No clear association
AT-hook DNA-binding motif-containing protein 1	Yang, H., Douglas, G., Monaghan, K. G., Retterer, K., Cho, M. T., Escobar, L. F., … Chung, W. K. (2015). De novo truncating variants in the AHDC1 gene encoding the AT-hook DNA-binding motif-containing protein 1 are associated with intellectual disability and developmental delay. Cold Spring Harb Mol Case Stud, 1, a000562. Wang, Q., Huang, X., Liu, Y., Peng, Q., Zhang, Y., Liu, J., & Yuan, H. (2019). Microdeletion and microduplication of 1p36.11p35.3 involving AHDC1 contribute to neurodevelopmental disorder. European Journal of Medical Genetics, Article in Press. https://doi.org/10.1016/j.ejmg.2019.01.001

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
25311	ctg7180001851039_10290_SAC	Distribution-SNP	ssa09	55068124	intergenic_region	LOC106611576-LOC106611580	n.55068124T>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
215345	106611580	9:55026673:55131334	ctg7180001851039_10290_SAC	9.0	55076673.0	55081334.0	LOC106611580	tryptophan 2	3-dioxygenase A-like
215386	106611581	9:55048962:55380563	ctg7180001851039_10290_SAC	9.0	55098962.0	55330563.0	LOC106611581	teneurin-3-like isoform X7	protein_coding

Same as for SalmoBreed.

	References
tryptophan 2,3-dioxygenase A	Breda, C., Sathyasaikumar, K. V, Idrissi, S. S., Notarangelo, F. M., Estranero, J. G., Moore, G. G., … Giorgini, F. (2016). Tryptophan-2,3-dioxygenase (TDO) inhibition ameliorates neurodegeneration by modulation of kynurenine pathway metabolites. PNAS, 113, 5435–5440. Kanai, M., Funakoshi, H., Takahashi, H., Hayakawa, T., Mizuno, S., Matsumoto, K., & Nakamura, T. (2009). Tryptophan 2,3-dioxygenase is a key modulator of physiological neurogenesis and anxiety-related behavior in mice. Molecular Brain, 2, 8. Stone, T. W., Stoy, N., & Darlington, L. G. (2013). An expanding range of targets for kynurenine metabolites of tryptophan. Trends in Pharmacological Sciences, 34, 136–143. Ohira, K., Hagihara, H., Toyama, K., Takao, K., Kanai, M., Funakoshi, H., … Miyakawa, T. (2010). Expression of tryptophan 2,3-dioxygenase in mature granule cells of the adult mouse dentate gyrus. Molecular Brain, 3, 26.
teneurin-3	Antinucci, P., Nikolaou, N., Meyer, M. P., & Hindges, R. (2013). Teneurin-3 specifies morphological and functional connectivity of retinal ganglion cells in the vertebrate visual system. Cell Reports, 5, 582–592.

	Kenzelmann, D., Chiquet-Ehrismann, R., & Tucker, R. P. (2007). Teneurins, a transmembrane protein family involved in cell communication during neuronal development. Cellular and Molecular Life Sciences, 64, 1452–1456. Mosca, T. J., Hong, W., Dani, V. S., Favaloro, V., & Luo, L. (2012). Trans-synaptic Teneurin signalling in neuromuscular synapse organization and target choice. Nature, 484, 237–241. Berns, D. S., DeNardo, L. A., Pederick, D. T., & Luo, L. (2018). Teneurin-3 controls topographic circuit assembly in the hippocampus. Nature, 554, 328–333. Hong, W., Mosca, T. J., & Luo, L. (2012). Teneurins instruct synaptic partner matching in an olfactory map. Nature, 484, 201–207.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
17230	ctg7180001888084_235_SCT	Distribution-SNP	ssa02	9446772	upstream_gene_variant	LOC106576116	c.-2112A>G

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
43111	106576116	2:9398861:9499571	ctg7180001888084_235_SCT	2.0	9448861.0	9449571.0	LOC106576116	SPRY domain-containing SOCS box protein 1-like	protein_coding	X
43119	106576347	2:9426484:9627865	ctg7180001888084_235_SCT	2.0	9476484.0	9577865.0	LOC106576347	glutamate receptor ionotropic	kainate 5-like	
621101	106576102	2:9387844:9488531	ctg7180001888084_235_SCT	NaN	9437844.0	9438531.0	LOC106576102	NaN	lncRNA	

	References
SPRY domain-containing SOCS box protein	No clear association, probably immunology
glutamate receptor ionotropic	Glutamate reseptor hiten er identisk med AquaGen? Nei, forskjellig kromosom 2 og 11 Adams, J., Crosbie, J., Wigg, K., Ickowicz, A., Pathare, T., Roberts, W., … Barr, C. L. (2004). Glutamate receptor, ionotropic, N-methyl D-aspartate 2A (GRIN2A) gene as a positional candidate for attention-deficit/hyperactivity disorder in the 16p13 region. Molecular Psychiatry, 9, 494–499. Oh, D. H., Son, H., Hwang, S., & Kim, S. H. (2012). Neuropathological abnormalities of astrocytes, GABAergic neurons, and pyramidal neurons in the dorsolateral prefrontal cortices of patients with major depressive disorder. European Neuropsychopharmacology, 22, 330–338.

	Kocerha, J., Faghihi, M. A., Lopez-Toledano, M. A., Huang, J., Ramsey, A. J., Caron, M. G., … Wahlestedt, C. (2009). MicroRNA-219 modulates NMDA receptor-mediated neurobehavioral dysfunction. Proceedings of the National Academy of Sciences, 106, 3507–3512. Wang, X., Zhao, Y., Zhang, X., Badie, H., Zhou, Y., Mu, Y., … Xu, H. (2013). Loss of sorting nexin 27 contributes to excitatory synaptic dysfunction by modulating glutamate receptor recycling in Down's syndrome. Nature Medicine, 19, 473–480. Martínez, G., Vidal, R. L., Mardones, P., Serrano, F. G., Ardiles, A. O., Wirth, C., … Hetz, C. (2016). Regulation of Memory Formation by the Transcription Factor XBP1. Cell Reports, 14, 1382–1394. Lalouette, A., Lohof, A., Sotelo, C., Guénet, J. L., & Mariani, J. (2001). Neurobiological effects of a null mutation depend on genetic context: Comparison between two hotfoot alleles of the delta-2 ionotropic glutamate receptor. Neuroscience, 105, 443–455. Ramanan, V. K., Kim, S., Holohan, K., Shen, L., Nho, K., Risacher, S. L., … Saykin, A. J. (2012). Genome-wide pathway analysis of memory impairment in the Alzheimer's Disease Neuroimaging Initiative (ADNI) cohort implicates gene candidates, canonical pathways, and networks. Brain Imaging and Behavior, 6, 634–648.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
9051	ctg7180001863290_453_SCT	functional	ssa23	35950060	missense_variant	mettl20	c.703G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	F
513940	106584539	23:35836930:35958472	ctg7180001863290_453_SCT	23.0	35886930.0	35908472.0	LOC106584539	uncharacterized protein LOC106584539 isoform X1	protein_coding	X
513948	106584538	23:35892463:35998188	ctg7180001863290_453_SCT	23.0	35942463.0	35948188.0	amn1	protein AMN1 homolog isoform X4	protein_coding	X
513968	106584537	23:35898930:36001220	ctg7180001863290_453_SCT	23.0	35948930.0	35951220.0	mettl20	protein N-lysine methyltransferase METTL20	protein_coding	X
513985	106584536	23:35903856:36015924	ctg7180001863290_453_SCT	23.0	35953856.0	35965924.0	LOC106584536	mixed lineage kinase domain-like protein	protein_coding	X
513988	106584535	23:35916027:36030930	ctg7180001863290_453_SCT	23.0	35966027.0	35980930.0	LOC106584535	E3 ubiquitin-protein ligase RFWD3-like	protein_coding	X
514012	106584534	23:35932154:36072426	ctg7180001863290_453_SCT	23.0	35982154.0	36022426.0	LOC106584534	Golgi apparatus protein 1-like	protein_coding	X

	References
AMN1	Cervantes-Sandoval, I., & Davis, R. L. (2012). Distinct traces for appetitive versus aversive olfactory memories in DPM neurons of Drosophila. Current Biology, 22, 1247–1252. Keene, A. C., Stratmann, M., Keller, A., Perrat, P. N., Vosshall, L. B., & Waddell, S. (2004). Diverse odor-conditioned memories require

	uniquely timed dorsal paired medial neuron output. Neuron, 44, 521–533.
METTL20	No clear association
mixed lineage kinase domain protein	No clear association
RFWD3	No clear association
Golgi apparatus protein	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
17337	ctg7180001593480_3370_SAC	Distribution-SNP	ssa02	16771122	intergenic_region	LOC106579240-LOC106579246	n.16771122C>A

GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Protein_product	Strand	Len	Row_no	Gid

	References
R-spondin-3	Ohkawara, B., Glinka, A., & Niehrs, C. (2011). Rspo3 Binds Syndecan 4 and Induces Wnt/PCP Signaling via Clathrin-Mediated Endocytosis to Promote Morphogenesis. Developmental Cell, 20, 303–314. Ota, S., Ishitani, S., Shimizu, N., Matsumoto, K., Itoh, M., & Ishitani, T. (2012). NLK positively regulates Wnt/β-catenin signalling by phosphorylating LEF1 in neural progenitor cells. The EMBO Journal, 31, 1904–1915. Rong, X., Chen, C., Zhou, P., Zhou, Y., Li, Y., Lu, L., … Duan, C. (2014). R-spondin 3 regulates dorsoventral and anteroposterior patterning by antagonizing Wnt/β-catenin signaling in zebrafish embryos. PLoS ONE, Vol. 9, p. e99514. de Lau, W. B. M., Snel, B., & Clevers, H. C. (2012). The R-spondin protein family. Genome Biology, 13, 242. de Lau, W., Peng, W. C., Gros, P., & Clevers, H. (2014). The R-spondin/Lgr5/Rnf43 module: Regulator of Wnt signal strength. Genes and Development, 28, 305–316. Li, J. Y., Chai, B., Zhang, W., Fritze, D. M., Zhang, C., & Mulholland, M. W. (2014). LGR4 and its ligands, R-spondin 1 and R-spondin 3, regulate food intake in the hypothalamus of male rats. Endocrinology, 155, 429–440. Yu, Y., Moberly, A. H., Bhattarai, J. P., Duan, C., Zheng, Q., Li, F., … Ma, M. (2017). The Stem Cell Marker Lgr5 Defines a Subset of Postmitotic Neurons in the Olfactory Bulb. The Journal of Neuroscience, 37, 9403–9414.

	Barrios-Camacho, C. M. (2018). Expression of Bona Fide Epithelial Stem Cell Marker in Postmitotic Olfactory Bulb Neurons Suggest Novel Roles for Wnt Signaling in the Brain. The Journal of Neuroscience, 38, 2920–2922.
tRNA (guanine(10)-N2)-methyltransferase	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
36633	ctg7180001833869_486_SCT	Distribution-SNP	ssa16	47245536	intergenic_region	LOC106574075-LOC106574044	n.47245536G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
400080	106574075	16:46991789:47285906	ctg7180001833869_486_SCT	16.0	47041789.0	47235906.0	LOC106574075	nuclear factor 1 A-type-like	protein_coding
400091	106574044	16:47228465:47346192	ctg7180001833869_486_SCT	16.0	47278465.0	47296192.0	LOC106574044	TM2 domain-containing protein 1-like	protein_coding

	References
nuclear factor 1 A-type	Zhang, J., & Jiao, J. (2015). Molecular Biomarkers for Embryonic and Adult Neural Stem Cell and Neurogenesis. BioMed Research International, 2015, 727542. Sanosaka, T., Imamura, T., Hamazaki, N., Chai, M. C., Igarashi, K., Ideta-Otsuka, M., … Nakashima, K. (2017). DNA Methylome Analysis Identifies Transcription Factor-Based Epigenomic Signatures of Multilineage Competence in Neural Stem/Progenitor Cells. Cell Reports, 20, 2992–3003. Tyssowski, K., Kishi, Y., & Gotoh, Y. (2014). Chromatin regulators of neural development. Neuroscience, 264, 4–16. Schwarz, T. J. (2012). Examining new interactors of Notch / RBPJ signalling in adult neural stem cells. PhD Thesis, Technische Universität, München. Retrieved from https://mediatum.ub.tum.de/1098778
TM2 domain-containing protein 1	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
7431	ctg7180001591304_4622_SGT	functional	ssa14	34030280	missense_variant	LOC106569383	c.580C>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
350113	106569394	14:33942803:34046266	ctg7180001591304_4622_SGT	14.0	33992803.0	33996266.0	LOC106569394	zinc finger protein 333-like	protein_coding
350134	106569382	14:33954230:34079291	ctg7180001591304_4622_SGT	14.0	34004230.0	34029291.0	tep1	telomerase protein component 1	protein_coding
350145	106569383	14:33979334:34081305	ctg7180001591304_4622_SGT	14.0	34029334.0	34031305.0	LOC106569383	zinc finger protein 233-like	protein_coding
350153	106569381	14:33997947:34102341	ctg7180001591304_4622_SGT	14.0	34047947.0	34052341.0	LOC106569381	zinc finger protein 436-like isoform X2	protein_coding
350170	106569380	14:34002462:34112753	ctg7180001591304_4622_SGT	14.0	34052462.0	34062753.0	LOC106569380	nectin-4-like	protein_coding
350180	106569423	14:34027812:34130055	ctg7180001591304_4622_SGT	14.0	34077812.0	34080055.0	LOC106569423	high affinity immunoglobulin epsilon receptor ...	protein_coding

Same as for both SalmoBreed and Rauma.

	References
zinc finger protein 333	No clear association, probably immunology
telomerase protein component 1	No clear association
zinc finger protein 233	No clear association
zinc finger protein 436	Obayashi, S., Tabunoki, H., Kim, S. U., & Satoh, J. I. (2009). Gene expression profiling of human neural progenitor cells following the serum-induced astrocyte differentiation. Cellular and Molecular Neurobiology, 29, 423–438.
nectin-4	Mizoguchi, A., Nakanishi, H., Kimura, K., Matsubara, K., Ozaki-Kuroda, K., Katata, T., … Takai, Y. (2002). Nectin: An adhesion molecule involved in formation of synapses. Journal of Cell Biology, 156, 555–565. Lim, S. T., Lim, K.-C., Giuliano, R. E., & Federoff, H. J. (2008). Temporal and Spatial Localization of Nectin-1 and l-Afadin during Synaptogenesis in Hippocampal Neurons. The Journal of Comparative Neurology, 507, 1228–1244. Takai, Y., & Nakanishi, H. (2003). Nectin and afadin: novel organizers of intercellular junctions. Journal of Cell Science, 116, 17–27. Ogita, H., & Takai, Y. (2006). Nectins and nectin-like molecules: Roles in cell adhesion, polarization, movement, and proliferation. IUBMB Life, 58, 334–343. Katsunuma, S., Honda, H., Shinoda, T., Ishimoto, Y., Miyata, T., Kiyonari, H., … Togashi, H. (2016). Synergistic action of nectins and cadherins generates the mosaic cellular pattern of the olfactory epithelium. Journal of Cell Biology, 212, 561–575.
high affinity immunoglobulin epsilon receptor	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
44199	ctg7180001538584_4406_SGT	Distribution-SNP	ssa23	34429256	intergenic_region	LOC106584451-LOC106584480	n.34429256A>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Protein_product
513701	106584451	23:34247228:34454817	ctg7180001538584_4406_SGT	23.0	34297228.0	34404817.0	LOC106584451	potassium voltage-gated channel subfamily KQT ...	partial	protein_coding

	References
potassium voltage-gated channel subfamily KQT..	Klemmer, P., Smit, A. B., & Li, K. W. (2009). Proteomics analysis of immuno-precipitated synaptic protein complexes. Journal of Proteomics, 72, 82–90. Lu, A., Wisniewaki, J. R., & Mann, M. (2009). Comparative proteomic profiling of membrane proteins in rat cerebellum, spinal cord, and sciatic nerve. Journal of Proteome Research, 8, 2418–2425. Sheffield, A. M., & Smith, R. J. H. (2018). The Epidemiology of Deafness. Cold Spring Harbor Perspectives in Medicine doi: 10.1101/Cshperspect.A033258. Yang, Y., Wang, X., Liu, Y., Fu, Q., Tian, C., Wu, C., … Liu, Z. (2018). Transcriptome analysis reveals enrichment of genes associated with auditory system in swimbladder of channel catfish. Comparative Biochemistry and Physiology - Part D, 27, 30–39. Kumar, D., Ambasta, R. K., & Kumar, P. (2014). Mutational Consequences of Aberrant Ion Channels in Neurological Disorders. Journal of Membrane Biology, 247, 1083–1127.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
44228	ctg7180001809345_1074_SCT	Distribution-SNP	ssa23	36182565	upstream_gene_variant	LOC106584531	c.-5173G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
514064	100195695	23:36053225:36188764	ctg7180001809345_1074_SCT	23.0	36103225.0	36138764.0	urah	5-hydroxyisourate hydrolase	protein_coding
514078	106584530	23:36088860:36203079	ctg7180001809345_1074_SCT	23.0	36138860.0	36153079.0	LOC106584530	AFG3-like protein 1	protein_coding
514084	106584529	23:36102962:36310627	ctg7180001809345_1074_SCT	23.0	36152962.0	36260627.0	LOC106584529	voltage-dependent calcium channel subunit alph...	protein_coding
514118	106584531	23:36137419:36240741	ctg7180001809345_1074_SCT	23.0	36187419.0	36190741.0	LOC106584531	leucine-rich repeat and transmembrane domain-c...	protein_coding

Same as for Rauma.

	References
5-hydroxyisourate hydrolase	No clear association
AFG3-like protein 1	No clear association, but a few relevant hits: Rugarli, E. I., & Langer, T. (2012). Mitochondrial quality control: A matter of life and death for neurons. The EMBO Journal, 31, 1336–1349. Rugarli, E. I., & Langer, T. (2006). Translating m-AAA protease function in mitochondria to hereditary spastic paraplegia. Trends in Molecular Medicine, 12, 262–269. Ferreirinha, F., Pirozzi, M., Valsecchi, V., Broccoli, V., Auricchio, A., Ballabio, A., … Rugarli, E. I. (2004). Axonal degeneration in paraplegin-deficient mice is associated with abnormal mitochondria and impairment of axonal transport. Journal of Clinical Investigation, 113, 231–242. Tanner, A. J., & Dice, J. F. (1996). Batten Disease and mitochondrial pathways of proteolysis. Biochemical and Molecular Medicine, 57, 1–9. Nolden, M., Ehses, S., Koppen, M., Bernacchia, A., Rugarli, E. I., & Langer, T. (2005). The m-AAA protease defective in hereditary spastic paraplegia controls ribosome assembly in mitochondria. Cell, 123, 277–289. Burté, F., Carelli, V., Chinnery, P. F., & Yu-Wai-Man, P. (2015). Disturbed mitochondrial dynamics and neurodegenerative disorders. Nature Reviews Neurology, 11, 11–24.
voltage-dependent calcium channel subunit alpha	Hirasawa, M., Xu, X., Trask, R. B., Maddatu, T. P., Johnson, B. A., Naggert, J. K., … Ikeda, A. (2007). Carbonic anhydrase related protein 8 mutation results in aberrant synaptic morphology and excitatory synaptic function in the cerebellum. Mol. Cell. Neurosci., 35, 161–170.
leucine-rich repeat and transmembrane domain-c…	Sarria, I., Cao, Y., Wang, Y., Kefalov, V. J., Sampath, A. P., Martemyanov, K. A., … Kamasawa, N. (2018). LRIT1 Modulates Adaptive Changes in Synaptic Communication of Cone Photoreceptors. Cell Reports, 22, 3562–3573. Cobb, C. A. (2018). Functional and structural impact of the loss of the leucine-rich repeat protein LRIT1 in the mouse retina . Electronic Theses and Dissertations. Paper 2968. Retrieved from https://doi.org/10.18297/etd/2968 Winther M., Walmod P.S. (2014) Neural Cell Adhesion Molecules Belonging to the Family of Leucine-Rich Repeat Proteins. In: Berezin V., Walmod P. (eds) Cell Adhesion Molecules. Advances in Neurobiology, vol 8. Springer, New York, NY

	Ueno, A., Omori, Y., Sugita, Y., Watanabe, S., Chaya, T., Kozuka, T., … Furukawa, T. (2018). Lrit1, a Retinal Transmembrane Protein, Regulates Selective Synapse Formation in Cone Photoreceptor Cells and Visual Acuity. Cell Reports, 22, 3548–3561.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
28165	ctg7180001626552_1091_SAG	Distribution-SNP	ssa10	107341104	intron_variant	LOC106561641	c.-75-12234G>A

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	I
261911	106561641	10:107205810:107459430	ctg7180001626552_1091_SAG	10.0	107255810.0	107409430.0	LOC106561641	contactin-1a-like	protein_coding	[illegible]

	References
contactin-1a	Miura, Y., Devaux, J. J., Fukami, Y., Manso, C., Belghazi, M., Wong, A. H. Y., … Yamamoto, T. (2015). Contactin 1 IgG4 associates to chronic inflammatory demyelinating polyneuropathy with sensory ataxia. Brain, 138, 1484–1491. Lamprianou, S., Chatzopoulou, E., Thomas, J.-L., Bouyain, S., & Harroch, S. (2011). A complex between contactin-1 and the protein tyrosine phosphatase PTPRZ controls the development of oligodendrocyte precursor cells. PNAS, 108, 17498–17503. Colakoglu, G., Bergstrom-Tyrberg, U., Berglund, E. O., & Ranscht, B. (2014). Contactin-1 regulates myelination and nodal/paranodal domain organization in the central nervous system. PNAS, 111, E394–E403. Zacharias, U., & Rauch, U. (2006). Competition and cooperation between tenascin-R, lecticans and contactin 1 regulate neurite growth and morphology. Journal of Cell Science, 119, 3456–3466. Bouyain, S., & Watkins, D. J. (2010). The protein tyrosine phosphatases PTPRZ and PTPRG bind to distinct members of the contactin family of neural recognition molecules. PNAS, 107, 2443–2448. Rush, A. M., Craner, M. J., Kageyama, T., Dib-Hajj, S. D., Waxman, S. G., & Ranscht, B. (2005). Contactin regulates the current density and axonal expression of tetrodotoxin-resistant but not tetrodotoxin-sensitive sodium channels in DRG neurons. European Journal of Neuroscience, 22, 39–49. Schwarting, G. A., & Henion, T. R. (2011). Regulation and function of axon guidance and adhesion molecules during olfactory map formation. Journal of Cellular Biochemistry, 112, 2663–2671. Puzzo, D., Bizzoca, A., Privitera, L., Furnari, D., Giunta, S., Girolamo, F., … Palmeri, A. (2013). F3/Contactin promotes hippocampal

	neurogenesis, synaptic plasticity, and memory in adult mice. Hippocampus, 23, 1367–1382.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
18970	ctg7180001631827_192_SAC	Distribution-SNP	ssa03	56012380	intron_variant	gbgt1	c.68+24842G>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Pro
83764	100194757	3:55915832:56087519	ctg7180001631827_192_SAC	3.0	55965832.0	56037519.0	gbgt1	globoside alpha-1	3-N-acetylgalactosaminyltransferase 1 isoform X2	p
83773	106600864	3:55974738:56075461	ctg7180001631827_192_SAC	3.0	56024738.0	56025461.0	LOC106600864	globoside alpha-1	3-N-acetylgalactosaminyltransferase 1-like	p
83782	106600863	3:56012132:56148043	ctg7180001631827_192_SAC	3.0	56062132.0	56098043.0	LOC106600863	integrin alpha-3-like isoform X1	protein_coding	XP_

Same as for SalmoBreed.

	References
gbgt1	No clear association
globoside alpha-1	No clear association
integrin alpha-3	Huang, A.-M., Wang, H. L., Tang, Y. P., & Lee, E. H. Y. (1998). Expression of Integrin-Associated Protein Gene Associated with Memory Formation in Rats. The Journal of Neuroscience, 18, 4305–4313. Clegg, D. O., Wingerd, K. L., Hikita, S. T., & Tolhurst, E. C. (2003). Integrins in the development, function and dysfunction of the nervous system. [Frontiers in Bioscience, 8, d723-750. Stipp, C. S., & Hemler, M. E. (2000). Transmembrane-4-superfamily proteins CD151 and CD81 associate with α3β1 integrin, and selectively contribute to α3β1-dependent neurite outgrowth. Journal of Cell Science, 113, 1871–1882. Chang, H. P., Lindberg, F. P., Wang, H. L., Huang, A. M., & Lee, E. H. Y. (1999). Impaired memory retention and decreased long-term potentiation in integrin-associated protein-deficient mice. Learning and Memory, 6, 448–457. Stanco, A., Szekeres, C., Patel, N., Rao, S., Campbell, K., Kreidberg, J. A., … Anton, E. S. (2009). Netrin-1– α3β1 integrin interactions regulate the migration of interneurons through the cortical marginal zone. PNAS, 106, 7595–7600.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
17249	ctg7180001295039_234_SAG	Distribution-SNP	ssa02	10562168	intron_variant	LOC106576689	c.55-797C>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
43470	106576689	2:10503163:10627272	ctg7180001295039_234_SAG	2.0	10553163.0	10577272.0	LOC106576689	chloride channel protein 1-like isoform X3	protein_coding
43482	106576719	2:10528250:10640006	ctg7180001295039_234_SAG	2.0	10578250.0	10590006.0	LOC106576719	caspase-2-like isoform X1	protein_coding
43493	106576972	2:10558900:10664678	ctg7180001295039_234_SAG	2.0	10608900.0	10614678.0	LOC106576972	rap1 GTPase-activating protein 2-like	protein_coding
621527	106576318	2:10552772:10656750	ctg7180001295039_234_SAG	NaN	NaN	NaN	NaN	NaN	NaN

	References
chloride channel protein 1	No clear association
caspase-2	Troy, C. M., Rabacchi, S. A., Hohl, J. B., Angelastro, J. M., Greene, L. A., & Shelanski, M. L. (2001). Death in the Balance: Alternative Participation of the Caspase-2 and -9 Pathways in Neuronal Death Induced by Nerve Growth Factor Deprivation. The Journal of Neuroscience, 21, 5007–5016. Suzuki, Y., & Farbman, A. I. (2000). Tumor necrosis factor-α-induced apoptosis in olfactory epithelium in vitro: Possible roles of caspase 1 (ICE), caspase 2 (ICH-1), and caspase 3 (CPP32). Experimental Neurology, 165, 35–45. Cowan, C. M., & Roskams, A. J. (2002). Apoptosis in the mature and developing olfactory neuroepithelium. Microscopy Research and Technique, 58, 204–215. Suzuki, Y. (2007). Apoptosis and the insulin-like growth factor family in the developing olfactory epithelium. Anatomical Science International, 82, 200–206. Dash, P. K., Blum, C. A. S., & Moore, A. N. (2000). Caspase activity plays an essential role in long-term memory. Neuroreport, 11, 2811–2816. Pozueta, J., Lefort, R., Ribe, E. M., Troy, C. M., Arancio, O., & Shelanski, M. (2013). Caspase-2 is required for dendritic spine and behavioural alterations in J20 APP transgenic mice. Nature Communications, 4, 1939. Zhao, X., Kotilinek, L. A., Smith, B., Hlynialuk, C., Zahs, K., Ramsden, M., … Ashe, K. H. (2016). Caspase-2 cleavage of tau reversibly impairs memory. Nature Medicine, 22, 1268–1276.
rap1 GTPase-activating protein 2	No clear association

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
42679	ctg7180001925561_4576_SAC	Distribution-SNP	ssa22	1397901	intron_variant	LOC106582631	c.1241-3111A>C

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype
488543	106582631	22:1069117:1757593	ctg7180001925561_4576_SAC	22.0	1119117.0	1707593.0	LOC106582631	receptor-type tyrosine-protein phosphatase T-l...	protein_coding

	References
receptor-type tyrosine-protein phosphatase T/PTPRT	Zheng, J. J., Li, W. X., Liu, J. Q., Guo, Y. C., Wang, Q., Li, G. H., … Huang, J. F. (2018). Low expression of aging-related NRXN3 is associated with Alzheimer disease: A systematic review and meta-analysis. Medicine (Baltimore), 97, e11343. Mattheus, T., Kukla, K., Zimmermann, T., Tenzer, S., & Lutz, B. (2016). Cell Type-Specific Tandem Affinity Purification of the Mouse Hippocampal CB1 Receptor-Associated Proteome. Journal of Proteome Research, 15, 3585–3601. Lim, S. H., Moon, J., Lee, M., & Lee, J. R. (2013). PTPRT regulates the interaction of Syntaxin-binding protein 1 with Syntaxin 1 through dephosphorylation of specific tyrosine residue. Biochemical and Biophysical Research Communications, 439, 40–46. Lee, J. R. (2015). Protein tyrosine phosphatase PTPRT as a regulator of synaptic formation and neuronal development. BMB Reports, 48, 249–255. Thirtamara Rajamani, K., O'Neill, B., Han, D. D., Frostholm, A., Rotter, A., & Gu, H. H. (2015). Inactivation of the catalytic phosphatase domain of PTPRT/RPTPρ increases social interaction in mice. Autism Research, 8, 19–28. Besco, J. A., Hooft van Huijsduijnen, R., Frostholm, A., & Rotter, A. (2006). Intracellular substrates of brain-enriched receptor protein tyrosine phosphatase rho (RPTPρ/PTPRT). Brain Research, 1116, 50–57.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
17077	ctg7180001933798_3460_SGT	Distribution-SNP	ssa01	158726051	intergenic_region	trnaa-ugc-LOC106572858	n.158726051G>T

	GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Protein_product
616377	106572858	1:158682988:158802626	ctg7180001933798_3460_SGT	NaN	NaN	NaN	NaN	NaN	NaN	NaN

	References
tRNA-UGC	De Abreu, Diana Andrea Fernandes, Salinas-Giegé, Thalia, Maréchal-Drouard, Laurence, and Remy, Jean-Jacques (2019). Alanine tRNA Translate Environment into Behavior in Caenorhabditis Elegans Available at SSRN: https://ssrn.com/abstract=3310818 or http://dx.doi.org/10.2139/ssrn.3310818
hydroxysteroid dehydrogenase protein 2 (HSDL2)	No clear association, but a few relevant hits: Hales, C. M., Dammer, E. B., Deng, Q., Duong, D. M., Gearing, M., Troncoso, J. C., … Seyfried, N. T. (2016). Changes in the detergent-insoluble brain proteome linked to amyloid and tau in Alzheimer's Disease progression. Proteomics, 16, 3042–3053. Kousa, Y. A., Mansour, T. A., Seada, H., Matoo, S., & Schutte, B. C. (2017). Shared molecular networks in orofacial and neural tube development. Birth Defects Research, 109, 169–179.

	Cigene_id	Criteria	Chrom	Position	Annotation	Loc_info	SNP_info
47672	ctg7180001721295_376_SCT	Distribution-SNP	ssa28	30107494	intergenic_region	LOC106589868-LOC106589902	n.30107494T>C

GeneID	Range	SNP_ID	Chr	Gene_start	Gene_end	Gene_symbol	Pep	Biotype	Protein_product	Strand	Len	Row_no	Gid

	References
RNA binding protein fox-1 homolog 1 (RBFOX1)	Smith, R. M., & Sadee, W. (2011). Synaptic signaling and aberrant RNA splicing in autism spectrum disorders. Frontiers in Synaptic Neuroscience, 3, 1. Guo, Y., Mo, D., Zhang, Y., Zhang, Y., Cong, P., Xiao, S., … Chen, Y. (2012). MicroRNAome Comparison between Intramuscular and Subcutaneous Vascular Stem Cell Adipogenesis. PLoS ONE, 7, e45410. Xiong, W., & Zhou, D. (2017). Progress in unraveling the genetic etiology of rolandic epilepsy. Seizure, 47, 99–104. Wamsley, B., Jaglin, X. H., Favuzzi, E., Quattrocolo, G., Nigro, M. J., Yusuf, N., … Fishell, G. (2018). Rbfox1 Mediates Cell-type-Specific Splicing in Cortical Interneurons. Neuron, 100, 846–859. Fernàndez-Castillo, N., Gan, G., van Donkelaar, M. M. J., Vaht, M., Weber, H., Retz, W., … Cormand, B. (2017). RBFOX1, encoding a splicing regulator, is a candidate gene for aggressive behavior. European Neuropsychopharmacology, In Press, Corrected Proof. https://doi.org/10.1016/j.euroneuro.2017.11.012
charged multivesicular body protein 6	No clear association