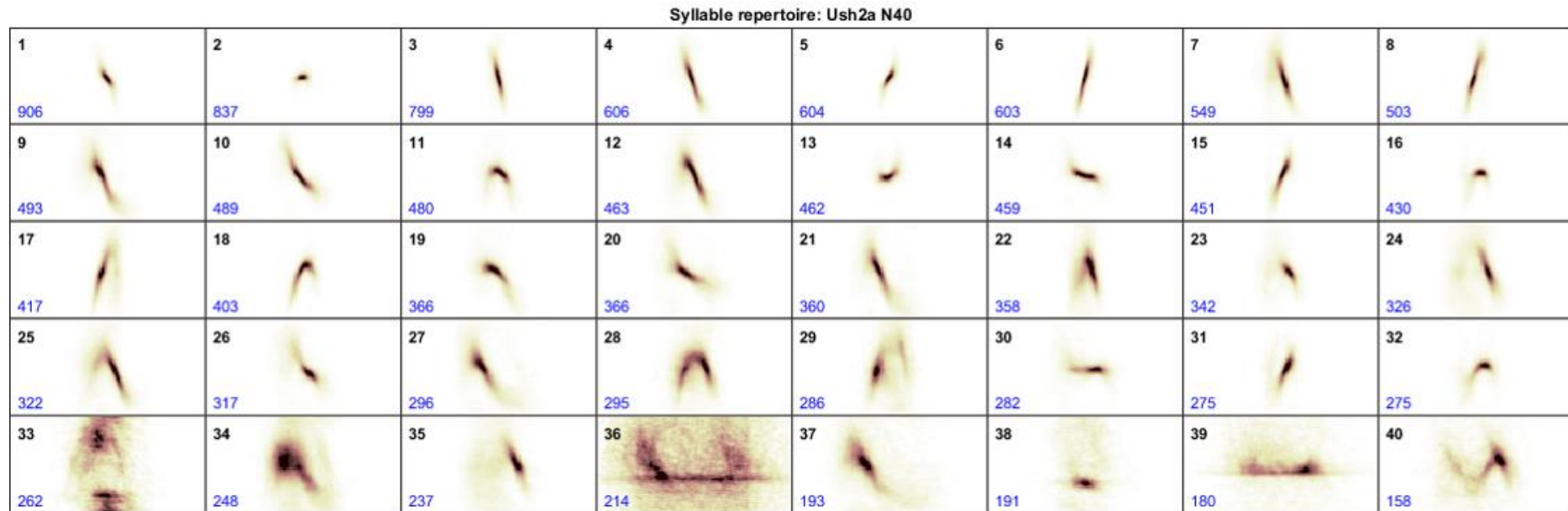**Online Supplement for** *Multi-level evidence of an allelic hierarchy of USH2A variants in hearing, auditory processing and speech/language outcomes*

Supplementary Figures

Supplementary Figure 1: Ush2a ultrasonic vocalization syllable repertoire generated from MUPET

40 unique syllables were generated via MUPET USV analysis (collapsed across all subjects). Each syallable was assigned to one of eight call types [80]. Number in bottom left corner indicates number of utterances seen across all subjects.

Supplementary Figure 2: Manhattan Plot of genomewide interaction study
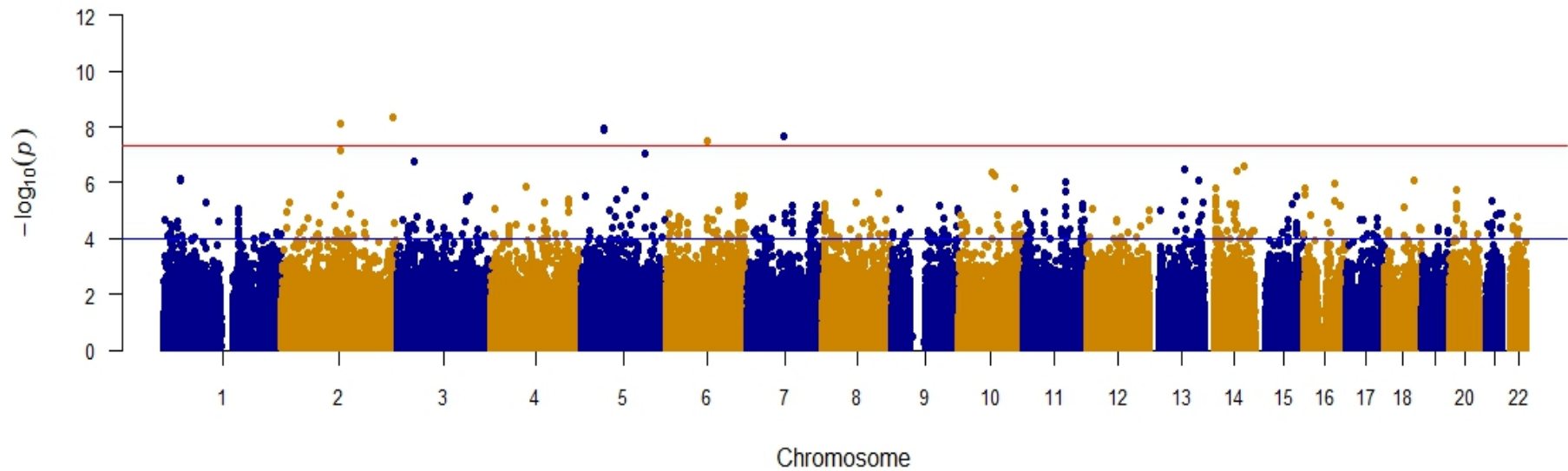
Four hundred and fifty SNPs had P-values≤10-5 and were entered into pathway analyses to identify gene pathways modulated by low frequency hearing.

Supplementary Tables

Supplementary Table 1: Language and hearing candidate genes

Hearing-related Genes							Language-related Genes	
AAK1	COL11A1	EPS8L2	IFNLR1	MYO6	PPIP5K2	TJP2	ARID1A	STARD9
ACSL4	COL11A2	ERAL1	IKZF5	MYO7A	PPM1A	TMC1	ATP2C2	SYNPR
ACTG1	COL2A1	ESPN	IL1R2	NARS2	PRPS1	TMEM132E	AUTS2	TM4SF20
ACVR2A	COL4A3	ESRP1	ILDR1	NDP	PTPRQ	TMEM30B	BCL11A	TNRC6B
ADCY1	COL4A4	ESRRB	KARS	NEDD4L	RDX	TMIE	CHD3	TRIO
AHSG	COL4A5	EWSR1	KCNJ10	NFATC3	ROR1	TMPRSS3	CMIP	WDR5
AIFM1	COL4A6	EYA1	KCNQ1	NIN	RP11-166N6.3	TMTC4	*CNTNAP2*	ZFHX4
ANKRD11	COL9A1	EYA4	KCNQ4	NISCH	RP11-20I23.1	TNC	CNTNAP5	
AP3M2	COL9A2	FAM65B	KIAA1024L	NLRP3	S1PR2	TOX	CTNND2	
AP3S1	COL9A3	FOXI1	KITLG	NM_001702	SEMA3E	TPRN	DCDC2	
ATP2B1	CRYM	GATA2	KLC2	NM_032119	SEMA3F	TRAM2	DOCK4	
BAIAP2L2	CTC-454I21.3	GGA1	KLHL18	NPTN	SERPINB6	TRIOBP	DYX1C1	
BDP1	CYB5R2	GIPC3	LARS2	OCM2	SIX1	*TSPEAR*	ERC1	
BSND	DCDC2	GJB2	LHFPL5	ODF3L2	SIX5	UBE2B	*FOXP1*	
CABP2	DFNB31	GJB3	LOXHD1	OSBPL2	SLC17A8	UBE2G1	FOXP2	
CCDC50	DFNB59	GJB6	LRTOMT	OTOA	SLC22A4	USH1C	GRIN2A	
CCDC88C	DIABLO	GPR152	MARVELD2	OTOF	SLC26A4	USH1G	GRIN2B	
CCDC92	DIAPH1	GPR50	MCM2	OTOG	SLC26A5	*USH2A*	KAT6A	
CD164	DIAPH3	GPR98	MED28	OTOGL	SLC4A10	VTI1A	KIAA0319	
CDC14A	DMXL2	GPSM2	MET	P2RX2	SLC5A5	WBP2	KMT2D	
CDH23	DNASE1	GRHL2	MIR96	PAX3	SMPX	WDTC1	*MACROD2*	
CEACAM16	DUOXA2	GRXCR1	*MITF*	PCDH15	SNAI2	WFS1	MKL2	
CH507-396I9.6	EDN3	GRXCR2	MPDZ	PDZD7	SOX10	ZCCHC14	NFXL1	
CHD7	EDNRB	GSDME	MSRB3	PHF6	SPNS2		OXR1	
CIB2	ELMOD1	HARS	MYH1	PNPT1	SRRM4		ROBO1	
CLDN14	ELMOD3	HARS2	MYH14	POLR1C	STRC		SCN9A	
CLIC5	EMB	HGF	MYH9	POLR1D	SYNE4		SEMA6D	
CLPP	EPS8	HOMER2	MYO15A	POU3F4	TCOF1		SETBP1	
COCH	EPS8L1	HSD17B4	MYO3A	POU4F3	TECTA		SRPX2	

Hearing-related (N=197) and language-related (N=37) genes from literature. Genes highlighted in grey and bold had SNP hits with P-values <10-5 in the GWIs

Supplementary Notes, Discussion, Methods

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