Supplementary Table 1: *Demographic and clinical characteristics of patients with epilepsy*

Experiment	Sex	Age	Seizure onset	Confirmed Seizures	Diagnosis	ASMs at time of surgery	Tissue specimen
AFC	F	52	13	Yes	Bilateral TLE, HS Type 1	BRIV, LTG	Lateral neocortex
mACSF	M	46	19	Yes	TLE	LEV, LCS, CEN	Lateral neocortex
AFC	M	57	21	Yes	FLE	CLOB, LTG, LEV, MID	Frontal cortex
mACSF	M	47	37	Yes	TLE	CLOB, ESLI, LTG	Lateral neocortex
AFC	M	28	8	Yes	TLE, bottom of sulcus FCD Type 2A	LTG, LAC, LEV	Lateral neocortex
mACSF	M	22	17	Yes	TLE	LAC, MID, VAL, ZON	Temporal neocortex
AFC	M	37	37	Yes	Grade 4 astrocytoma, isolated seizure	None	Peritumoural
AFC	F	77	77	Yes	GBM, collapse/query seizure	None	Temporal peritumoural cortex
AFC	F	39	23	Yes	TLE	BRIV, CLB, LCS, LTG	Lateral neocortex
mACSF	M	50	36	Yes	TLE	VPA, ZNS	Lateral neocortex
mACSF	F	24	3	Yes	FLE	ESLI, ZNS	Lateral neocortex
CBZ+ AFC	F	39	28	Yes	TLE, MTS+ (right side); epilepsy tissue secondary to stroke	CEN, ESLI, LSM	Lateral neocortex
CBZ + AFC	F	30	21	Yes	"MRI negative, PET positive" right TLE	ESLI, LCS	Lateral neocortex
CBZ + AFC	F	40	23	Yes	Right TLE	LTG, LCS	Lateral neocortex
LZ+AFC	M	48	48	yes	Grade 2 oligodendroglioma. Acute symptomatic seizures.	LEV	Frontotemporal peritumoural cortex
CBZ + AFC	M	69	69	yes	Grade 3 oligodendroglioma. Acute symptomatic seizures.	LEV	Parietal peritumoural cortex
LZ+AFC	M	37	0.5	Yes	Long standing TLE	BRV, CLB, LTG, LZP, MID, OXC, PB, VPA, ZNS	Left posterior quadrant TPO disconnection with IOM
CBZ+ AFC	F	55	21	Yes	Long-standing drug refractory TLE	BRV, CEN, LCM	Lateral neocortex
LZ+AFC ; CBZ + Betaine	M	35	19	Yes	Long-standing drug refractory localisation related epilepsy, cause unknown	BRV, CEN, LTG, PER	Posterior left insula resection
CBZ + JnJ	M	71	-	Yes	Query localisation related epilepsy cause unknown	CEN, LTG	Right sided anterior temporal lobectomy

CBZ + JnJ; CBZ + Betaine	M	36	-	Yes	Medication refractory TLE	LEV, LCM, PHT	Lateral neocortex
mACSF	M	38	N/A	No	Non epilepsy/no seizure history	None	Lateral neocortex
CBZ + JnJ; CBZ + Betaine	M	51	51	Yes	Acute symptomatic isolated generalised tonic clonic seizure	LEV	Lateral neocortex
mACSF	F	34	N/A	No	Left frontal diffusely infiltrating grade 2 astrocytoma	-	Peritumoral cortex
CBZ + JnJ; LZ + AFC	M	36	36	Yes	Query isolated symptomatic seizure	LEV	Peritumoral cortex
CBZ + AFC	M	48	48	Yes	Glioblastoma	LEV, BD	Peritumoral cortex
mACSF	M	54	N/A	No	Glioblastoma	LEV, BD	Peritumoral cortex

Abbreviations: *BRIV*, Brivaracetam; *CEN*, Cenobamate; *CLB*, Clobazam; *CLOB*, Clobazam; *ESLI*, Eslicarbazepine; *FCD*, Focal Cortical Dysplasia; *FLE*, Frontal Lobe Epilepsy; *GBM*, Glioblastoma; *HGG*, High-Grade Glioma; *HS*, Hippocampal sclerosis; *IOM*, Intraoperative Monitoring; *LAC*, Lacosamide; *LCS*, Lacosamide; *LEV*, Levetiracetam; *LSM*, Lacosamide; *LTG*, Lamotrigine; *LZP*, Lorazepam; *MID*, Midazolam; *MTS*, Mesial Temporal Sclerosis; *MRI*, Magnetic Resonance Imaging; *OXC*, Oxcarbazepine; *PB*, Phenobarbital; *PER*, Perampanel; *PET*, Positron Emission Tomography; *PHT*, Phenytoin; *TLE*, Temporal lobe epilepsy; *TPO*, Temporo-Parieto-Occipital; *VAL*, Valproate; *ZNS*, Zonisamide; *ZON*, Zonisamide