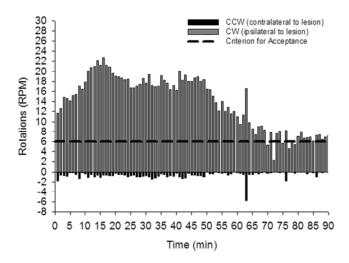
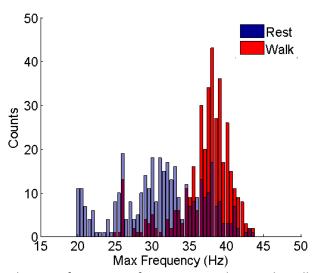


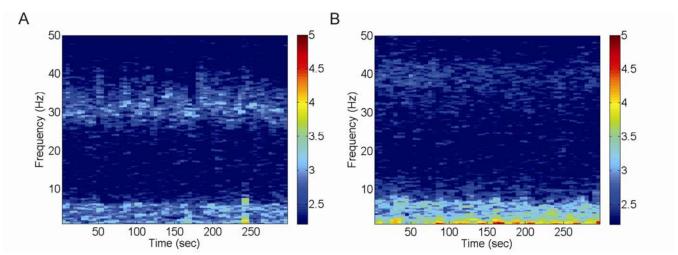
Supplementary Figure 1: Location of ECoG electrodes and craniotomy for STN DBS. ECoG electrodes were located bilaterally AP 1.7, ML 2.5 and AP –1.3, ML 1.2 mm, r.e. bregma. Two reference electrodes were located over parietal cortex and the cerebellum. The DBS electrode was positioned AP -3.6, ML 2.5, mm r.e. bregma. Rostral is at left.



Supplementary Figure 2: Amphetamine challenge. 6-OHDA lesioned animals were given an injection of amphetamine to determine the number of rotations ipsilateral to the lesion an animal made in 90 minutes. The criterion for acceptance of an animal in this study is six rotations per minute. CCW rotations (contralateral to the lesion) are coded as negative. In this example, the animal (STN 8) made a significant number of ipsilateral rotations. Data are in 1 min bins.



Supplementary Figure 3: Distribution of maximum frequencies. Abnormal oscillations typically occur between 20-45 Hz. Data are the distribution of frequencies that exhibit maximum power in the power spectral density for all possible recordings while the animal is at rest (blue) or walking on the treadmill (red). Distributions are in 0.5 Hz bins.



Supplementary Figure 4: Parkinsonian power in ECoG recordings is consistent over time. Spectrograms from a single Parkinsonian animal A) at rest and B) walking on a treadmill show consistent power in the β -band and low γ -band, respectively as a function of time. Units are in decibels. Data representative of STN 6.

Supplementary Table 1: Kolmogorov-Smirnov Tests. Probability < 0.05 presented in bold.

0.534

0.918

0.81

0.55

On DBS

Off DBS

8

4

	OBS		J			,	•			
	Parkinsonian				Normal		Frequency			
All Parameters	N	Ζ	р	N	Ζ	р			Parkinsonian	
On DBS	750	2.91	<0.001	300	1.49	0.024	At Max Charge	N	Ζ	р
Off DBS	10	0.81	0.536	4	0.4	0.998	0 Hz	10	0.81	0.536
At Max Charge							50 Hz	50	1.32	0.063
On DBS	250	2.02	0.001	100	1.21	0.108	125 Hz	50	1.35	0.053
Off DBS	10	0.81	0.536	4	0.4	0.998	200 Hz	50	1.04	0.23
							275 Hz	50	1.11	0.168
L	Distributi	on of Maxi	mum Frequ	encies			350 Hz	50	0.74	0.644
_	l	Parkinsonia	an							
All Parameters	N	Ζ	р				C	Charge		
At Rest	380	1	0.268						Parkinsonia	an
Walking	380	3.25	<0.001				All Parameters	N	Ζ	р
							0ηC	10	0.81	0.535
S	State						0.2 ηC	50	0.55	0.551
At Rest_	l	Parkinsonia	an				0.5 ηC	50	0.96	0.319
At Max Charge	N	Ζ	р				1.0 ηC	50	1.01	0.257
On DBS	125	1.04	0.234				2.0 ηC	50	1.1	0.174
Off DBS	5	0.84	0.474				4.0 ηC	50	1.35	0.053
Walking										
At Max Charge							A	Amplitud	le	
On DBS	125	1.92	0.001						Parkinsonia	an
Off DBS	5	0.45	0.989				At Max Charge	N	Ζ	р
							0 μΑ	10	0.81	0.535
E	Behavior						8 μΑ / 480 μs	50	1.11	0.171
_	I	Parkinsonia	an		Normal		16 μΑ / 240 μs	50	1	0.275
All behavior	N	Ζ	р	N	Ζ	р	33 μΑ / 120 μs	50	1.41	0.039

0.945

0.999

 $65\,\mu A$ / $60\,\mu s$

 $130\,\mu\text{A}$ / $30\,\mu\text{s}$

50

50

1.11

1.3

0.174

0.07

0.53

0.37

4

2

Supplementary Table 2: Statistical analyses. Frequency (Hz), Charge (nC), and Current (μ A). Probability < 0.05 presented in bold.

Wilcoxon DBS On - All Parameters Z -1.89 Wilcoxon Z -2.7 At Max Charge Z -2.7 Frequency Parkins One-way ANOVA At Max Charge F (5,259) 3.31 Charge One-way ANOVA Parkins All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA At Max Charge X2 13.83	<i>p</i> 0.059 <i>p</i> 0.007			p 0.465 p 0.305 Frequency 50	At M		State Parkins Rest (DBS t 2.64 Walk (DBS Z -1.48	On - Off) p 0.058	
Wilcoxon All ParametersDBS On - Z -1.89Wilcoxon At Max ChargeZ-2.7Frequency Parkinsone-way ANOVA At Max ChargeF(5,259)3.31Charge one-way ANOVA All Parameters (5,259)ParkinsAll ParametersF(5,259)4.34AmplitudeFriedman ANOVA At Max ChargeParkinsAt Max Charge\(\chi_2\)2	p 0.059 p 0.007	t-test	DBS On Z -0.73 t -1.124 0 0.378	- DBS off p 0.465 p 0.305 Frequency 50	At M	Max Charge Wilcoxon	Rest (DBS t 2.64 Walk (DBS Z	0n - Off) p 0.058 On - Off) p	
-1.89 Wilcoxon	0.059 p 0.007 sonian p	Bonferroni post-hoc 50 125 200	-0.73 t -1.124 0 0.378	0.465 p 0.305 Frequency 50	At M	Wilcoxon	2.64 Walk (DBS Z	0.058 On - Off)	
Wilcoxon At Max Charge Z -2.7 Frequency Parkins one-way ANOVA At Max Charge (5,259) 3.31 Charge one-way ANOVA All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA At Max Charge Amplitude At Max Charge Z	<i>ρ</i> 0.007 sonian <i>ρ</i>	Bonferroni post-hoc 50 125 200	t -1.124 0 0.378	p 0.305 Frequency 50	(Hz)	-	Walk (DBS Z	On - Off) <i>p</i>	
Z	0.007 sonian <i>p</i>	Bonferroni post-hoc 50 125 200	-1.124 0 0.378	0.305 Frequency 50	(Hz)	-	Z	р	
-2.7 Frequency Parkins one-way ANOVA At Max Charge (5,259) 3.31 Charge one-way ANOVA Parkins All Parameters (5,259) 4.34 Amplitude Friedman ANOVA At Max Charge χ2	0.007 sonian <i>p</i>	post-hoc 50 125 200	-1.124 0 0.378	0.305 Frequency 50	(Hz)	ax Charge			
Frequency Parkins One-way ANOVA At Max Charge (5,259) 3.31 Charge One-way ANOVA Parkins All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA At Max Charge χ2	sonian p	post-hoc 50 125 200	0 0.378	Frequency 50	• •		-1.48		
Parkins one-way ANOVA At Max Charge F (5,259) 3.31 Charge one-way ANOVA Parkins All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA Parkins At Max Charge χ2	sonian p	post-hoc 50 125 200	0.378	50	• •				
Parkins one-way ANOVA At Max Charge (5,259) 3.31 Charge one-way ANOVA All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA At Max Charge χ2	sonian p	post-hoc 50 125 200	0.378	50	• •				
one-way ANOVA At Max Charge F (5,259) 3.31 Charge one-way ANOVA Parkins All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA Parkins At Max Charge χ2	р	50 125 200	0.378		123	200	275	350	
At Max ChargeF(5,259)3.31Chargeone-way ANOVAParkinsAll ParametersF(5,259)4.34AmplitudeFriedman ANOVAParkinsAt Max Chargeχ2				1		200	2/3	330	
Charge one-way ANOVA Parkins All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA Parkins At Max Charge χ2		200	0.084	1	1				
Charge one-way ANOVA Parkins All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA Parkins At Max Charge χ2	0.007		0.034	1	1	1			
one-way ANOVA All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA At Max Charge χ2		2/5	0.021	1	1	1	4		
one-way ANOVA All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA At Max Charge χ2			0.647	1	1	0.583	1	_	
one-way ANOVA All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA At Max Charge χ2		350	0.015	0.963	1	1	0.39	1	
All Parameters F (5,259) 4.34 Amplitude Friedman ANOVA Parkins At Max Charge χ2		Bonferroni		Charge (n	C)				
(5,259) 4.34 Amplitude Friedman ANOVA Parkins At Max Charge χ2	sonian	post-hoc	0	0.2	0.5	1	2	4	
Amplitude Friedman ANOVA Parkins At Max Charge χ2	р	0.2	1	1					
Amplitude Friedman ANOVA Parkins At Max Charge χ2	0.001	 0.5	1	1	1				
Friedman ANOVA Parkins At Max Charge χ2		1	1	1	1	1			
Friedman ANOVA Parkins At Max Charge χ2		2	1	1	1	1	1		
Friedman ANOVA Parkins At Max Charge χ2		4	0.039	0.007	0.003	0.032	0.422	1	
Friedman ANOVA Parkins At Max Charge χ2									
At Max Charge χ2		Tukey-Kran	nor	Current (u.	4)				
	p	post-hoc	0	8	16	33	65	130	
13.63	0.017	<i>post-noc</i> 8	0.561	1	10		0.5		
	0.017	16	0.301	0.619	1				
		33	0.11		0.905	1			
			0.0	0.099		_	1		
		65	0.007	0.017	0.561	0.989	0.005	4	
		130	0.056	0.331	0.998	0.992	0.835	1	
Behavior						Distributio	n of Max F	requencies	
Parkins			Normal			Parkinsonian			
Wilcoxon DBS On -	sonian	Wilcoxon				Wilcoxon	Walk -	Rest	
Rotations Z			Z	р	All P	arameters	Z	p	
1.95			-0.69	0.533			-13.9	<0.001	