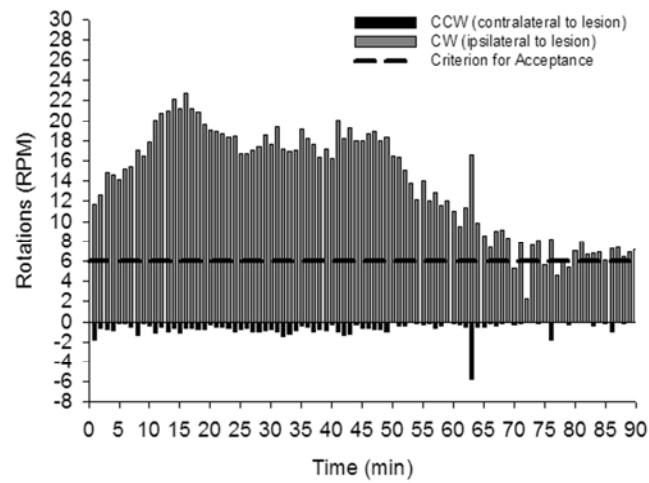
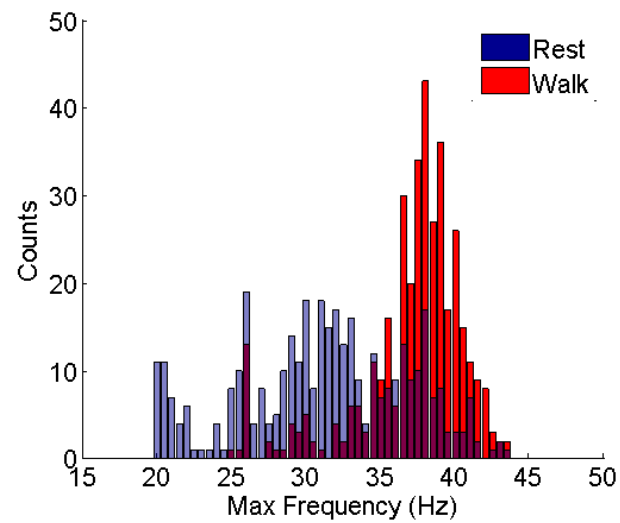


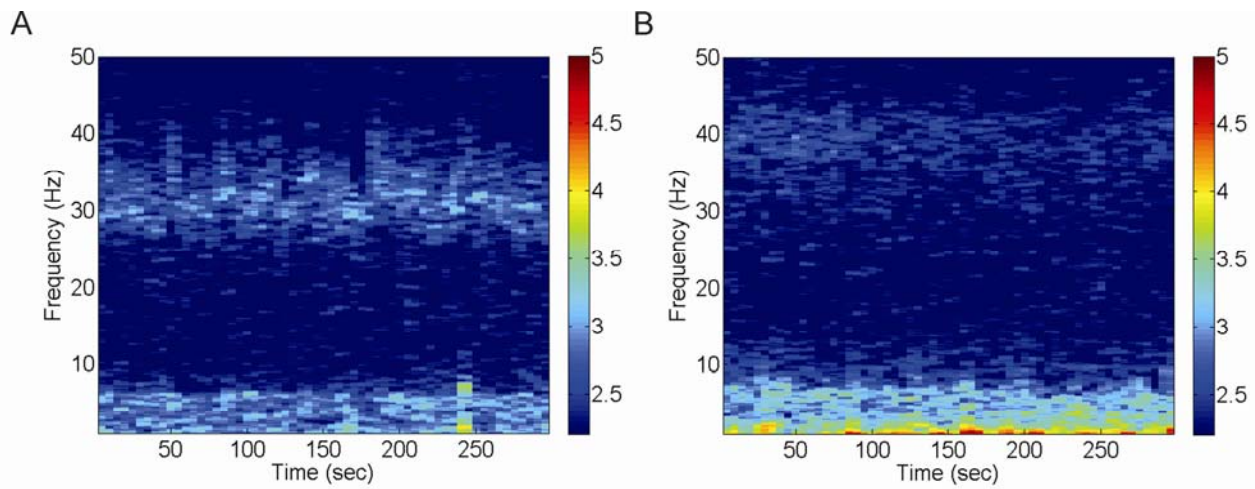
Supplementary Figure 1: Location of ECoG electrodes and craniotomy for STN DBS. ECoG electrodes were located bilaterally AP 1.7, ML 2.5 and AP -1.3, ML 1.2 mm, r.e. bregma. Two reference electrodes were located over parietal cortex and the cerebellum. The DBS electrode was positioned AP -3.6, ML 2.5,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

<i>DBS</i>											
<i>All Parameters</i>	Parkinsonian			Normal			<i>Frequency</i>				
	N	Z	<i>p</i>	N	Z	<i>p</i>	Parkinsonian				
On DBS	750	2.91	<0.001	300	1.49	0.024	<i>At Max Charge</i>	N	Z	<i>p</i>	
Off DBS	10	0.81	0.536	4	0.4	0.998	0 Hz	10	0.81	0.536	
<i>At Max Charge</i>							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	
<i>Distribution of Maximum Frequencies</i>							275 Hz	50	1.11	0.168	
							350 Hz	50	0.74	0.644	
<i>All Parameters</i>	Parkinsonian			<i>Charge</i>							
	N	Z	<i>p</i>	Parkinsonian							
At Rest	380	1	0.268	<i>All Parameters</i>	N	Z	<i>p</i>				
Walking	380	3.25	<0.001	0 ηC	10	0.81	0.535				
<i>State</i>							0.2 ηC	50	0.55	0.551	
At Rest	Parkinsonian			0.5 ηC	50	0.96	0.319				
<i>At Max Charge</i>	N	Z	<i>p</i>	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				<i>Amplitude</i>							
<i>At Max Charge</i>				Parkinsonian							
On DBS	125	1.92	0.001	<i>At Max Charge</i>	N	Z	<i>p</i>				
Off DBS	5	0.45	0.989	0 μA	10	0.81	0.535				
<i>Behavior</i>							8 μA / 480 μs	50	1.11	0.171	
<i>All behavior</i>	Parkinsonian			Normal			16 μA / 240 μs	50	1	0.275	
	N	Z	<i>p</i>	N	Z	<i>p</i>	33 μA / 120 μs	50	1.41	0.039	
On DBS	8	0.81	0.534	4	0.53	0.945	65 μA / 60 μs	50	1.11	0.174	
Off DBS	4	0.55	0.918	2	0.37	0.999	130 μA / 30 μs	50	1.3	0.07	

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

<i>DBS</i>					<i>State</i>					
Parkinsonian		Normal			Parkinsonian					
Wilcoxon	DBS On - DBS off	Wilcoxon	DBS On - DBS off		t-test	Rest (DBS On - Off)				
<i>All Parameters</i>	Z	p	Z	p	<i>At Max Charge</i>	t	p			
	-1.89	0.059	-0.73	0.465		2.64	0.058			
Wilcoxon			t-test			Wilcoxon	Walk (DBS On - Off)			
<i>At Max Charge</i>	Z	p	t	p	<i>At Max Charge</i>	Z	p			
	-2.7	0.007	-1.124	0.305		-1.48	0.138			

<i>Frequency</i>		<i>Bonferroni</i>		<i>Frequency (Hz)</i>						
Parkinsonian		<i>post-hoc</i>		0	50	125	200	275	350	
one-way ANOVA			50	0.378	1					
<i>At Max Charge</i>	F	p	125	0.084	1	1				
(5,259)	3.31	0.007	200	0.021	1	1	1			
			275	0.647	1	1	0.583	1		
			350	0.015	0.963	1	1	0.39	1	

<i>Charge</i>		<i>Bonferroni</i>		<i>Charge (nC)</i>						
Parkinsonian		<i>post-hoc</i>		0	0.2	0.5	1	2	4	
one-way ANOVA			0.2	1	1					
<i>All Parameters</i>	F	p	0.5	1	1	1				
(5,259)	4.34	0.001	1	1	1	1	1			
			2	1	1	1	1	1		
			4	0.039	0.007	0.003	0.032	0.422		1

<i>Amplitude</i>		<i>Tukey-Kramer</i>		<i>Current (µA)</i>						
Parkinsonian		<i>post-hoc</i>		0	8	16	33	65	130	
Friedman ANOVA			8	0.561	1					
<i>At Max Charge</i>	χ ²	p	16	0.11	0.619	1				
	13.83	0.017	33	0.021	0.099	0.905	1			
			65	0.007	0.017	0.561	0.989	1		
			130	0.056	0.331	0.998	0.992	0.835		1

<i>Behavior</i>					<i>Distribution of Max Frequencies</i>		
Parkinsonian		Normal			Parkinsonian		
Wilcoxon	DBS On - DBS off	Wilcoxon	DBS On - DBS off		Wilcoxon	Walk - Rest	
<i>Rotations</i>	Z	p	Z	p	<i>All Parameters</i>	Z	p
	1.95	0.049	-0.69	0.533		-13.9	<0.001