

ID in figures	Sample ID	Brain region	Age	Sex	PMI (hrs)	Diagnosis	Parkin Solubility	H2O2/Tissue ratio
a	1	F ctx	5	F	33	HCO	1	
b	2	F ctx	5	F	20	HCO	1	2.551
	3	F ctx	8	M	5	HCO	0	1.780
t	4	F ctx	13	M	13	HCO	1	2.217
	5	F ctx	15	F	9	HCO	1	1.349
j	6	F ctx	16	F	20	HCO	1	
c	7	F ctx	16	F	14	HCO	1	1.016
ff	8	F ctx	17	M	23	HCO	0	0.701
	9	F ctx	17	M	22	HCO	1	
k	10	F ctx	20	F	19	HCO	1	
o	11	F ctx	20	M	8	HCO	1	
	12	F ctx	20	M	6	HCO	0	
	13	F ctx	20	M	5	HCO	1	
	14	F ctx	21	M	30	HCO	1	
	15	F ctx	28	M	33	NCO	1	
d	16	F ctx	29	F	18	NCO	0	3.061
	17	F ctx	30	M	20	HCO	0	6.089
	18	F ctx	36	M	20	HCO	0	5.665
u	19	F ctx	37	F	13	HCO	0	
v	20	F ctx	38	M	17	HCO	0	
	21	F ctx	39	M	23	HCO	1	
e	22	F ctx	39	M	14	HCO	1	
	23	F ctx	42	M	18	HCO	1	
f	24	F ctx	43	F	22	HCO	0	4.601
	25	F ctx	44	F	21	NCO	0	
	26	F ctx	49	F	16	HCO	0	5.622
s	27	F ctx	49	F	14	HCO	0	
m	28	F ctx	54	M	16	NCO	0	
	29	F ctx	54	F	23	NCO	1	
w	30	F ctx	55	F	16	HCO	0	5.829
q	31	F ctx	56	M	23	HCO		
	32	F ctx	57	M		HCO	0	
g	33	F ctx	62	M	15	NCO	0	6.525
x	34	F ctx	65	M	5	PSM	0	6.473
z	35	F ctx	65	M	14	PSM	0	9.112
n	36	F ctx	65	F	42	HCO	0	5.768
h	37	F ctx	66	M		HCO	0	6.674
p	38	F ctx	68	M	17	HCO	0	2.514
i	39	F ctx	70	F		HCO	0	6.897
r	40	F ctx	70	M		HCO	0	5.459
aa	41	F ctx	72	M		PSM	1	6.274
	42	F ctx	75	M	48	HCO	1	2.878
	43	F ctx	75	F	13	NCO	0	
y	44	F ctx	75	M	17	PSM	0	
	45	F ctx	76	M	74	PSM	0	
l	46	F ctx	85	F	15	NCO	0	
bb	47	Midbrain	26	M	2	NCO	0	
	25	Midbrain	44	F	21	HCO	0	
ee	48	Midbrain	44	F	5	NCO	1	
	49	Midbrain	45	M	13	NCO	0	
	50	Midbrain	47	F	20	NCO	0	
	51	Midbrain	56	M	44	PSM	0	
	52	Midbrain	60	M	16	PSM	0	
	53	Midbrain	61	M	20	NCO	1	
cc	54	Midbrain	61	M	3.5	NCO	0	
n	36	Midbrain	65	F	42	HCO	0	
dd	55	Midbrain	65	M	6	NCO	0	
	41	Midbrain	72	M		PSM	1	
	56	Midbrain	74	F		NCO	0	
	42	Midbrain	75	M	48	HCO	0	
	57	Midbrain	75	M	70	PSM	0	
	45	Midbrain	76	M	74	PSM	0	
	58	Midbrain	79	M		PSM	0	
	59	Midbrain	82	M	48	PSM	1	
SC-1	60	Spinal cord/muscle	68	F	2.5	NCO	1	
SC-2	61	Spinal cord/muscle	64	F	2	HCO	1	
SC-3	62	Spinal cord/muscle	71		2		1	
SC-4	63	Spinal cord/muscle	50	M	4		1	

**Supplementary Table 1:** Summary of human brain tissue specimens used in this study with designated small letter identification, as used in the Figures. Abbreviations used: F ctx, frontal cortex; PMI, *post mortem* interval; hrs, hours; HCO, healthy control; NCO, neurological control; PSM, parkinsonism, n.d., not documented. For parkin solubility: 1, present in Tris-saline (TS) buffer; 0, not present in TS.

		r-parkin						
Treatment		Control		H <sub>2</sub> O <sub>2</sub>				
Run		IAA+NEM	IAA	20μM	1mM	4.5mM	4.5mM	4.5mM
Labelling				*IAA	+NEM			
Region	Cysteine Residues							
UBL	59		•	n/d	•	• +	•	•
Linker	95	•	•	•	•	• +	• +	• +
RING0	150	•	•	•	•	• +	• +	•
	154	•	•	n/d	•	• +	• +	•
	166	n/d	n/d	•	• +	n/d	•	•
	169	n/d	•	•	• +	n/d	•	•
	182	•	•	•	n/d	• +	• +	•
	196	•	•	•	•	• +	• +	• +
	201	•	•	•	•	• +	• +	• +
	212	•	•	•	n/d	• +	• +	• +
RING1	238	•	•	• +	•	• +	•	• +
	241	•	•	• +	•	• +	•	•
	253	•	•	• +	•	• +	•	•
	260	•	•	n/d	n/d	• +	•	•
	263	•	•	n/d	n/d	• +	•	•
	268	•	•	n/d	n/d	• +	•	•
	289	•	•	n/d	n/d	• +	• +	• +
	293	•	•	n/d	•	•	• +	• +
IBR	323	•	•	n/d	n/d	• +	• +	• +
	332	•	•	n/d	n/d	• +	•	•
	337	•	•	n/d	•	• +	•	• +
	352	•	•	•	•	•	• +	• +
	360	•	•	•	•	• +	•	•
	365	•	•	•	n/d	• +	•	•
	368	•	•	n/d	n/d	• +	• +	•
RING2	377	•	•	•	n/d	• +	• +	• +
	418	n/d	n/d	n/d	•	n/d	n/d	n/d
	421	n/d	n/d	n/d	• +	n/d	• +	• +
	431	n/d	•	n/d	•	n/d	•	•
	436	n/d	n/d	n/d	• +	n/d	•	•
	441	n/d	n/d	n/d	• +	n/d	•	•
	446	•	•	n/d	n/d	• +	• +	• +
	449	•	•	n/d	n/d	• +	• +	•
451	•	•	n/d	n/d	• +	•	•	
	457	•	•	•	•	• +	•	• +

### Supplementary Table 2: Parkin's cysteine residues are redox active.

Aliquots of human recombinant (r-) parkin that were oxidized by variable concentrations of H<sub>2</sub>O<sub>2</sub> vs. control preparations were differentially labelled with iodoacetamide (IAA) and/or N-ethylmaleimide (NEM); as in Figure 4A) to identify reduced cysteines (IAA) or reversibly-oxidized residues (NEM). Proteins were subjected to LC-MS/MS and analyzed using Mascot Scaffold PTM to identify IAA (•) or NEM (+) adducts indicating when these were detectable on individual residues. Cysteines that were not detected as modified in individual runs are also listed (n/d). Note that cysteines within all four RING domains of parkin as well as in the linker and UBL domains can be variably modified. Corresponding data can be found in Extended Data Fig. 4h. For comparison, see **Extended Data Table 1** that lists modified cysteines identified in parkin purified from human brain.