Supporting Information for:

Detailed mechanism of the oxidative half-reaction of D-amino acid oxidase: another route for flavin oxidation

Dóra Judit Kiss and György G. Ferenczy

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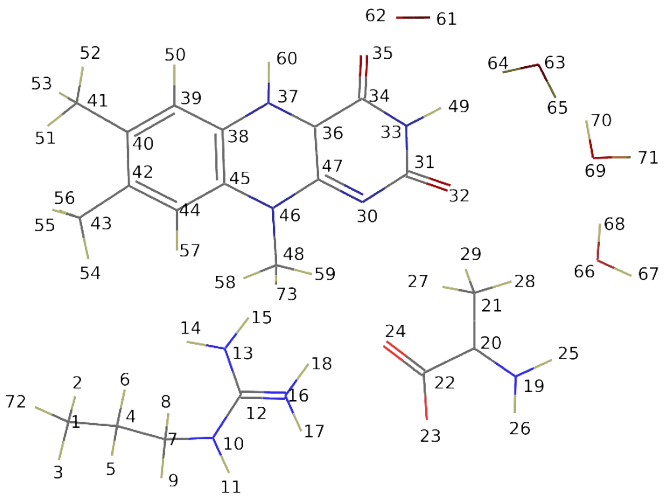
Table S1. Atomic charges of the QM system in stationary points as obtained with B3LYP/6-31+G** basis set using NBO analysis.



	O1^{T}	*O1*^{OSS}	*O2a*^{CSS}	*O3*^{CSS}
C 1	-0.689	-0.689	-0.689	-0.689
H 2	0.253	0.254	0.254	0.256
H 3	0.259	0.259	0.258	0.257
C 4	-0.494	-0.494	-0.493	-0.491
H 5	0.266	0.266	0.263	0.258
H 6	0.228	0.228	0.229	0.227
C 7	-0.279	-0.279	-0.279	-0.279
H 8	0.246	0.246	0.247	0.246
H 9	0.268	0.268	0.267	0.268
N10	-0.651	-0.651	-0.653	-0.661
H11	0.481	0.481	0.482	0.482
C12	0.685	0.685	0.684	0.682
N13	-0.898	-0.898	-0.899	-0.904
H14	0.458	0.458	0.457	0.453
H15	0.470	0.470	0.470	0.468
N16	-0.842	-0.842	-0.840	-0.845
H17	0.471	0.471	0.472	0.473
H18	0.458	0.459	0.457	0.453
N19	-0.681	-0.681	-0.688	-0.719
C20	0.377	0.377	0.377	0.250
C21	-0.765	-0.765	-0.764	-0.742
C22	0.771	0.771	0.779	0.778
O23	-0.763	-0.763	-0.768	-0.788
O24	-0.712	-0.712	-0.707	-0.733
H25	0.481	0.481	0.479	0.533
H26	0.494	0.494	0.496	0.434
H27	0.286	0.286	0.287	0.267

H28	0.273	0.273	0.273	0.248
H29	0.307	0.307	0.302	0.269
N30	-0.631	-0.631	-0.620	-0.613
C31	0.807	0.807	0.829	0.829
O32	-0.765	-0.764	-0.744	-0.722
N33	-0.672	-0.672	-0.676	-0.677
C34	0.628	0.628	0.678	0.679
O35	-0.669	-0.667	-0.681	-0.639
C36	0.032	0.031	0.130	0.106
N37	-0.505	-0.505	-0.361	-0.338
C38	0.154	0.153	0.101	0.104
C39	-0.243	-0.241	-0.168	-0.184
C40	-0.052	-0.051	-0.077	-0.064
C41	-0.701	-0.701	-0.699	-0.701
C42	-0.056	-0.056	-0.019	-0.007
C43	-0.699	-0.699	-0.702	-0.703
C44	-0.219	-0.217	-0.255	-0.249
C45	0.170	0.168	0.192	0.205
N46	-0.360	-0.360	-0.338	-0.328
C47	0.438	0.440	0.455	0.448
C48	-0.475	-0.476	-0.479	-0.481
H49	0.464	0.464	0.462	0.487
H50	0.262	0.262	0.258	0.268
H51	0.232	0.232	0.231	0.235
H52	0.248	0.248	0.246	0.250
H53	0.253	0.253	0.249	0.251
H54	0.244	0.244	0.249	0.251
H55	0.220	0.220	0.219	0.224
H56	0.258	0.258	0.260	0.262
H57	0.263	0.263	0.269	0.269
H58	0.217	0.217	0.217	0.220
H59	0.225	0.225	0.235	0.241
H60	0.483	0.483	0.511	0.531
O61	-0.419	-0.422	-0.615	-0.601
O62	-0.426	-0.428	-0.610	-0.554
O63	-1.084	-1.085	-1.126	-1.103
H64	0.533	0.533	0.528	0.535
H65	0.543	0.542	0.554	0.577
O66	-1.075	-1.075	-1.075	-1.067
H67	0.562	0.562	0.562	0.550
H68	0.540	0.540	0.539	0.542
O69	-1.098	-1.098	-1.107	-1.096
H70	0.544	0.544	0.545	0.544
H71	0.564	0.564	0.566	0.559
H72	0.162	0.162	0.161	0.158
H73	0.348	0.348	0.351	0.353

Table S2. QM/MM energies of the stationary points along the proposed pathway shown in blue in Figure 4. Geometries are calculated at QM/MM B3LYP/6-31G* level and energies at B3LYP/6-31+G** level. Energies of states with partial open shell singlet character were corrected using Eqs. 1-2. See Scheme 2 for the designation of states.

State	Energy (kcal mol^{-1})
$O1^{T}$	-1204809.852
MECP	-1204806.009
$O1^{OSS}$	-1204810.857
$TS^{O1OSS\rightarrow O2aCSS}$	-1204807.663
$O2a^{CSS}$	-1204820.204
$TS^{O2aCSS\rightarrow O3CSS}$	-1204810.517
$O3^{CSS}$	-1204828.765

Table S3. QM/MM energies of the stationary points along the pathway shown in red in Figure 4. Geometries are calculated at QM/MM B3LYP/6-31G* level and energies at B3LYP/6-31+G** level. Energies of states with partial open shell singlet character were corrected using Eqs. 1-2. See Scheme 2 for the designation of states.

State	Energy (kcal mol^{-1})
$TS^{O1OSS \rightarrow O2bOSS}$	-1204789.863
$O2b^{OSS}$	-1204798.750

Table S4. QM/MM energies of the stationary points along the covalent pathway (Scheme S1). Geometries are calculated at QM/MM B3LYP/6-31G* level and energies at B3LYP/6-31+G** level.

State	Energy (kcal mol^{-1})
$TS^{O1OSS \rightarrow O2cov}$	-1204798.24
$O2^{cov}$	-1204814.50

Coordinates of computed structures
Correspondence between structures (states) and files names. Files contain atomic coordinates in pdb format. See Schemes 2 and S1 for the designation of states.

State	File name
$O1^{T}$	O1T.pdb
MECP	MECP.pdb
$O1^{OSS}$	O1_OSS.pdb
$TS^{O1\rightarrow O2aCSS}$	O1TS_OSS.pdb
$O2a^{CSS}$	O2_CSS.pdb
$TS^{O2aCSS\rightarrow O3CSS}$	O2TS_CSS.pdb
$O3^{CSS}$	O3_CSS.pdb
$TS^{O1\rightarrow O2bOSS}$	O1TSbOSS.pdb
$O2b^{OSS}$	O2OSSb.pdb
$TS^{O1\rightarrow O2cov}$	O1TS_cov.pdb
$O2^{cov}$	O2_cov.pdb

Scheme S1. Covalent pathway investigated for the oxidative half-reaction of DAAO. The non-covalent pathway is shown as reference. T denotes triplet, OSS open shell singlet and CSS closed shell singlet states. The substrate does not change in the last step shown, therefore it is omitted in the second part of the scheme.

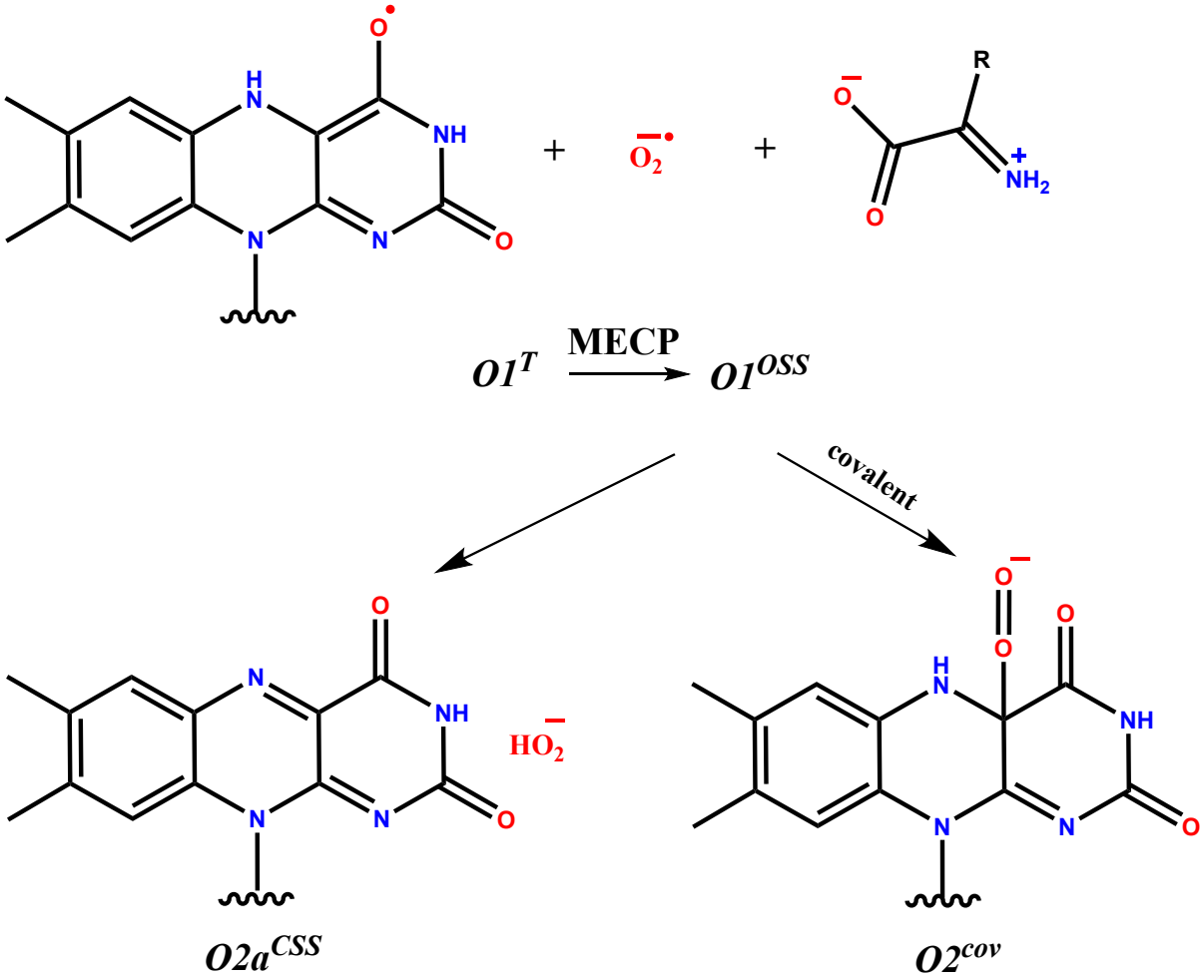


Figure S1. Characteristic geometrical parameters of the intermediates *R1* (a) and *R2* (c) and the transition state *R1TS* (b) for the reductive half-reaction.

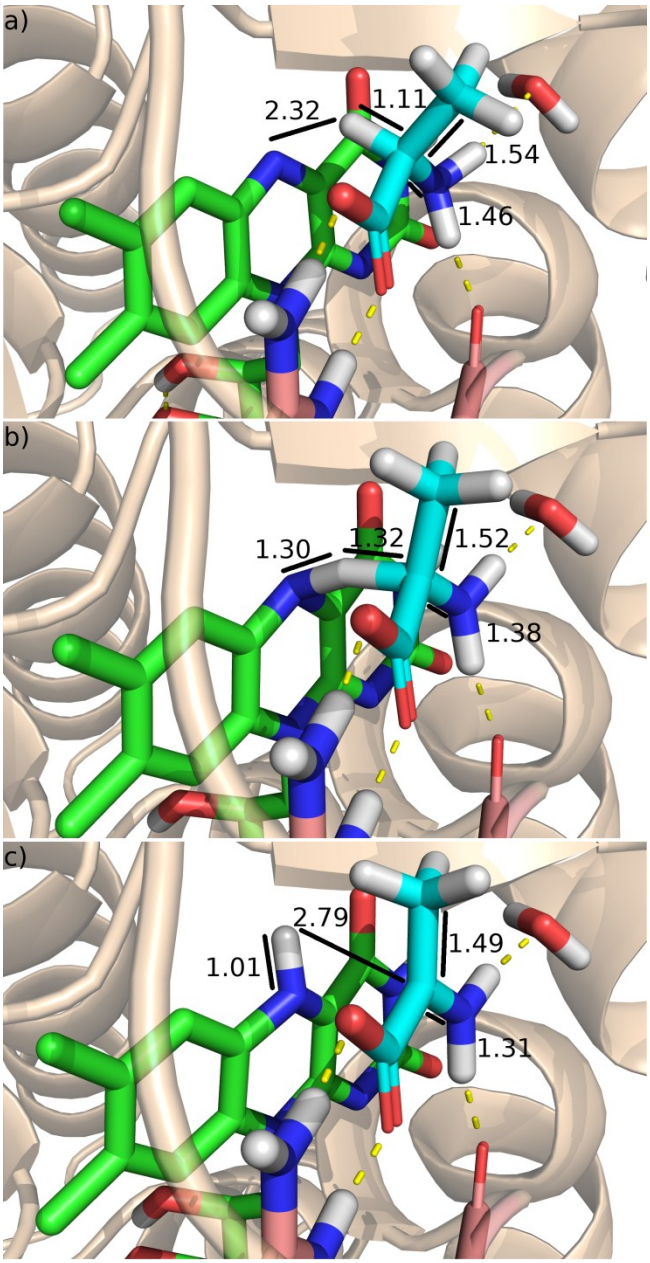


Figure S2. Energy profile of the covalent (red) and non-covalent (blue) pathways shown on Scheme S1. Geometries are calculated at QM/MM B3LYP/6-31G* level and energies at B3LYP/6-31+G** level.