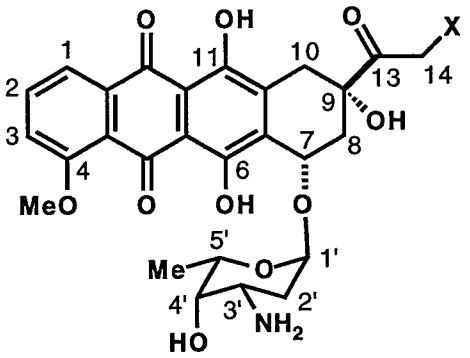
Journal of
Medicinal Chemistry
J. Med. Chem., 1997, 40(16), 2452-2461, DOI:10.1021/jm970237e

Table 3. 400 MHz, ^1H NMR Data for daunorubicin and daunorubicin-HCl.

	Chemical Shifts for Protons at Positions (Patterns, J Coupling Constants)															
1	2	3	4	6/11	7	8	9	10	14	1'	2'	3'	4'	5'	5'-Me	NH
daunorubicin (free base, $DCCl_3$, acidic protons identified by D_2O exchange)																
8.02 (d, 8)	7.71 (t, 8)	7.38 (d, 8)	4.07 (s)	14.01 (s) 13.29 (s)	5.29 (bdd, 1,4)	2.31 (dt, 15,1) 2.13 (dd, 4,15)	4.40 (s)	3.25 (dd, 18,1) 2.96 (d, 18)	2.41 (s)	5.61 (dd, 1,4)	2.28 (dd, 4,13) 1.93 (td, 13,4)	3.50 (ddd, 2,4,12)	4.16 (bs)	~4.09 (q, 7)	1.36 (d, 7)	---
daunorubicin (HCl salt, DMSO-d_6)																
7.91-7.94 (m)	7.91-7.94 (m)	7.65-7.67 (m)	3.98 (s)	14.04 (bs) 13.25	5.28 (~dd, ~3,6)	2.16 (dd, 3,14) 2.09 (dd, 6,14)	5.52 (s)	2.93 (s)	2.26 (s)	4.93 (t, ~4)	1.87 (td, 11,3-4) 1.67 (dd, 11,3)	3.33 (m) under H_2O	3.56 (bd, 6) 5.46 (d, 6)	4.20 (q, 6.5)	1.15 (d, 6.5)	7.85 (b)
daunorubicin (free base, DMSO-d_6)																
7.92 (m)	7.92 (m)	7.64 (m)	3.98 (s)	---	5.18 (~dd)	2.14 (dd) 2.09 (dd)	5.45 (s)	2.93 (d, 15) 2.82 (dd, 15,3)	2.24 (s)	4.93 (m)	1.58 (td, 9,3) 1.44 (dd, 9,5)	~2.9 (m) under 10	3.26? (bs) 4.44 (b, OH)	4.07 (q, 6.5)	1.12 (d, 6.5)	---



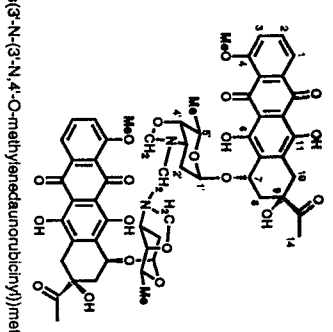
X=H, daunorubicin
X=OH, doxorubicin

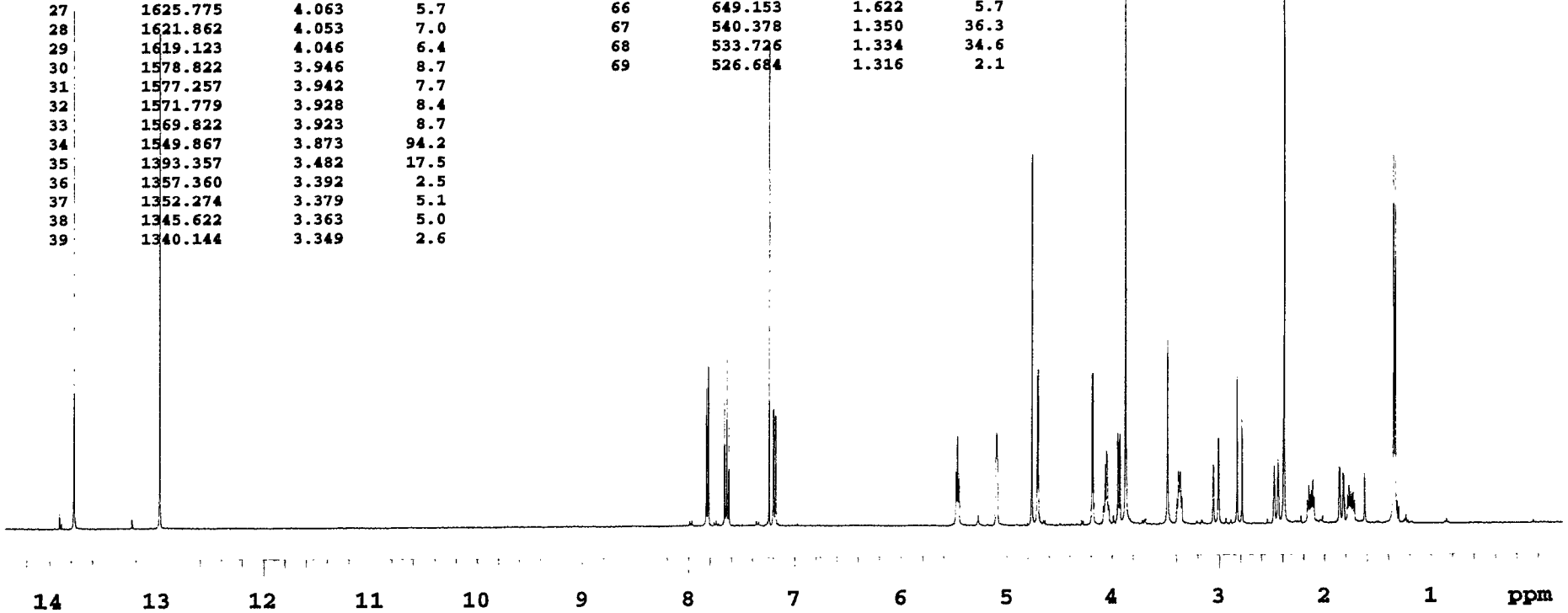
INDEX	FREQUENCY	PPM	HEIGHT
1	5564.348	13.906	2.2
2	5511.525	13.774	48.8
3	5296.324	13.236	1.8
4	5193.810	12.980	46.4
5	3134.922	7.835	11.0
6	3134.139	7.833	13.0
7	3127.488	7.816	15.2
8	3126.314	7.813	14.8
9	3066.449	7.663	12.1
10	3058.232	7.643	15.9
11	3050.406	7.623	11.4
12	2897.027	7.240	45.1
13	2880.593	7.199	11.8
14	2873.159	7.180	10.6
15	2194.297	5.484	5.0
16	2188.819	5.470	8.4
17	2183.341	5.456	4.8
18	2041.309	5.101	8.6
19	2039.743	5.098	8.7
20	2037.787	5.093	6.5
21	1906.319	4.764	35.0
22	1886.364	4.714	14.0
23	1882.060	4.703	14.6
24	1677.032	4.191	14.3
25	1672.728	4.180	14.3
26	1627.340	4.067	5.7
27	1625.775	4.063	5.7
28	1621.862	4.053	7.0
29	1619.123	4.046	6.4
30	1578.822	3.946	8.7
31	1577.257	3.942	7.7
32	1571.779	3.928	8.4
33	1569.822	3.923	8.7
34	1549.867	3.873	94.2
35	1393.357	3.482	17.5
36	1357.360	3.392	2.5
37	1352.274	3.379	5.1
38	1345.622	3.363	5.0
39	1340.144	3.349	2.6

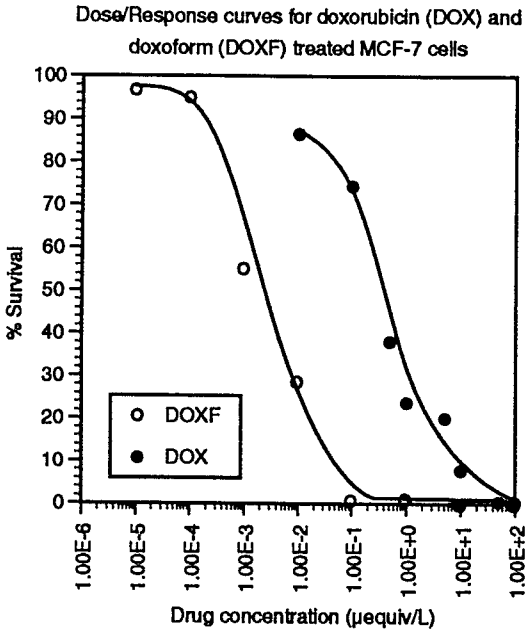
INDEX	FREQUENCY	PPM	HEIGHT
40	1223.544	3.058	5.5
41	1221.979	3.054	5.6
42	1204.763	3.011	8.0
43	1202.807	3.006	8.0
44	1133.551	2.833	13.9
45	1114.770	2.786	9.8
46	992.692	2.481	5.5
47	978.215	2.445	6.3
48	958.260	2.395	9.8
49	955.130	2.387	145.7
50	865.528	2.163	2.3
51	860.441	2.150	3.9
52	854.963	2.137	2.7
53	851.050	2.127	3.1
54	845.573	2.113	4.6
55	840.095	2.099	2.5
56	745.797	1.864	5.4
57	741.885	1.854	5.8
58	730.929	1.827	5.3
59	727.408	1.818	4.8
60	713.713	1.784	2.8
61	709.018	1.772	3.6
62	702.757	1.756	3.1
63	698.844	1.746	2.8
64	692.584	1.731	3.0
65	687.889	1.719	2.2
66	649.153	1.622	5.7
67	540.378	1.350	36.3
68	533.726	1.334	34.6
69	526.684	1.316	2.1

bis(3'-N-(3'-N,4'-O-methylenedaunorubicinyl))methane in $DCCl_3$

(Dsunoform)





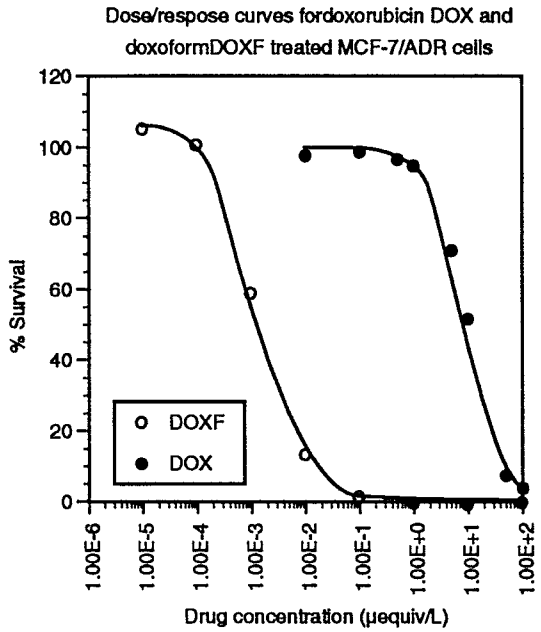


Raw data and calculations for doxorubicin treated MCF-7 cells (3h drug exposure)

	No Drug	Tris Killed	100 µeq/L	10 µeq/L	1 µeq/L	100 neq/L	10 neq/L	1 neq/L	0.1 neq/L	0.01 neq/L
OD_{588}	2.082	0.213	0.23	0.208	0.313	0.649	0.748	0.931	1.69	2.201
OD_{588}	2.215	0.154	0.171	0.165	0.339	0.587	0.614	1.086	1.764	1.94
OD_{588}	2.648	0.215	0.159	0.151	0.246	0.515	0.557	0.848	1.72	1.88
OD_{588}	2.073	0.138	0.163	0.161	0.383	0.517	0.64	0.83	1.72	1.924
OD_{588}	2.132	0.136	0.174	0.235	0.354	0.608	0.685	1.127	1.607	1.875
OD_{588}	2.213	0.145	0.162	0.162	0.342	0.618	0.707	0.91	1.685	1.878
Average	2.227	0.167	0.177	0.18	0.33	0.582	0.659	0.955	1.698	1.95
Std Dev	0.215	0.037	0.027	0.033	0.047	0.055	0.069	0.124	0.053	0.126
% Survival	100	0	0.469	0.655	7.895	20.167	23.864	38.271	74.301	86.532
% Std Dev	9.659	1.665	1.204	1.497	2.102	2.476	3.091	5.551	2.362	5.662

Raw data and calculations for doxoform treated MCF-7 cells (3h drug exposure)

	No Drug	Tris Killed	96 µeq/L	9.6 µeq/L	0.96 µeq/L	96 neq/L	9.6 neq/L	0.96 neq/L	0.096 neq/L	0.0096 neq/L
OD_{588}	1.171	0.16	0.154	0.169	0.193	0.18	0.48	0.839	1.238	1.304
OD_{588}	1.246	0.158	0.151	0.149	0.168	0.173	0.462	0.752	1.175	1.198
OD_{588}	1.431	0.153	0.159	0.158	0.167	0.153	0.468	0.768	1.414	1.152
OD_{588}	1.589	0.156	0.15	0.152	0.171	0.169	0.523	0.871	1.189	1.286
OD_{588}	1.472	0.151	0.163	0.166	0.186	0.173	0.635	1.007	1.408	1.74
OD_{588}	1.647	0.193	0.174	0.151	0.17	0.176	0.571	0.919	1.755	1.627
Average	1.426	0.162	0.159	0.158	0.176	0.171	0.523	0.859	1.363	1.385
Std Dev	0.187	0.016	0.009	0.008	0.011	0.009	0.068	0.096	0.219	0.241
% Survival	100	0	-0.264	-0.343	1.107	0.698	28.582	55.174	95.029	96.716
% Std Dev	13.12	1.095	0.635	0.586	0.765	0.659	4.802	6.71	15.349	16.895

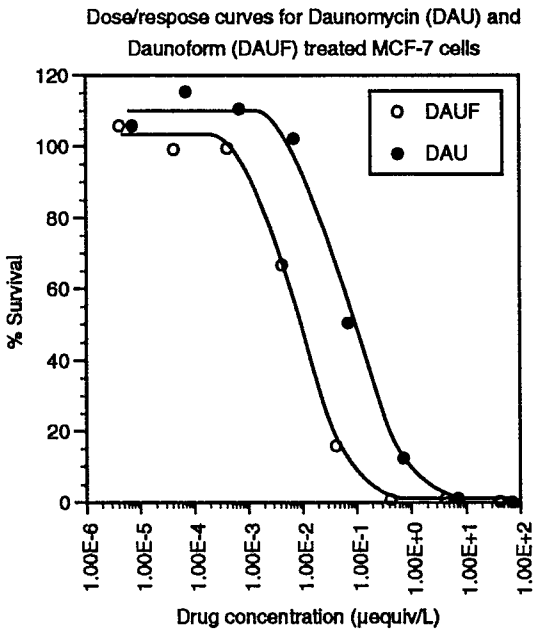


Raw data and calculations for doxorubicin treated MCF-7/ADR cells (3h drug exposure)

	No Drug	Tris Killed	100 µeq/L	10 µeq/L	1 µeq/L	100 neq/L	10 neq/L	1 neq/L	0.1 neq/L	0.01 neq/L
OD588	1.143	0.174	0.235	0.281	0.742	0.937	1.281	1.266	1.199	1.263
OD588	1.186	0.171	0.22	0.256	0.644	0.842	1.069	1.143	1.198	1.305
OD588	1.254	0.172	0.212	0.25	0.714	0.918	1.133	1.16	1.219	1.091
OD588	1.261	0.229	0.223	0.254	0.703	0.875	1.113	1.221	1.118	1.154
OD588	1.165	0.172	0.236	0.284	0.77	0.889	1.248	1.158	1.203	1.063
OD588	1.376	0.197	0.233	0.262	0.791	1.111	1.227	1.236	1.376	1.374
Average	1.231	0.186	0.227	0.265	0.727	0.929	1.179	1.197	1.219	1.208
Std Dev	0.086	0.023	0.01	0.015	0.053	0.095	0.085	0.05	0.085	0.125
% Survival	100	0	3.892	7.528	51.818	71.085	94.992	96.795	98.852	97.847
% Std Dev	6.948	1.898	0.787	1.178	4.268	7.74	6.897	4.088	6.888	10.121

Raw data and calculations for doxoform treated MCF-7/ADR cells (3h drug exposure)

	No Drug	Tris Killed	96 µeq/L	9.6 µeq/L	0.96 µeq/L	96 neq/L	9.6 neq/L	0.96 neq/L	0.096 neq/L	0.0096 neq/L
OD588	0.747	0.162	0.167	0.17	0.174	0.185	0.216	0.529	0.687	0.81
OD588	0.89	0.165	0.164	0.159	0.176	0.2	0.263	0.535	0.766	0.91
OD588	0.869	0.163	0.165	0.158	0.164	0.173	0.239	0.553	0.783	0.893
OD588	ERR	0.172	0.161	0.165	0.156	0.176	0.306	0.506	0.922	0.862
OD588	0.938	0.167	0.187	0.174	0.179	0.169	0.267	0.712	1.081	1.072
OD588	1.039	0.19	0.168	0.162	0.158	0.179	0.307	0.753	1.166	1.058
Average	0.897	0.17	0.169	0.165	0.168	0.18	0.266	0.598	0.901	0.934
Std Dev	0.106	0.01	0.009	0.006	0.01	0.011	0.036	0.106	0.19	0.107
% Survival	100	0	-0.16	-0.71	-0.27	1.45	13.28	58.92	100.59	105.17
% Std Dev	11.85	1.17	1.038	0.704	1.093	1.233	4.026	11.823	21.212	11.928

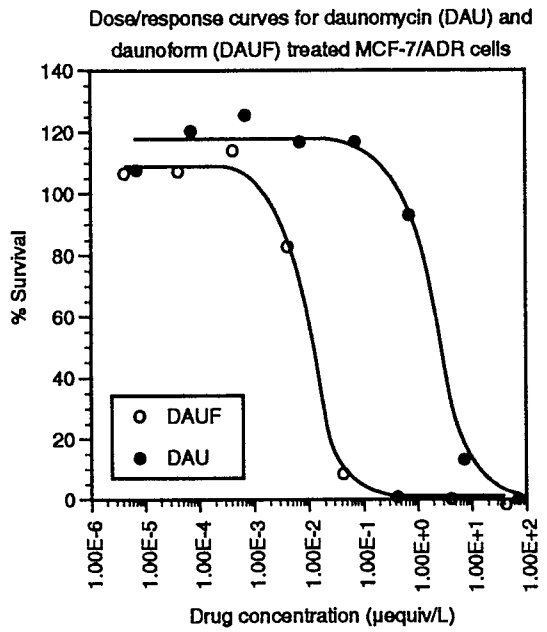


Raw data and calculations for daunomycin treated MCF-7 cells (3h drug exposure)

	No Drug	Tris Killed	71 µeq/L	7.1 µeq/L	0.71 µeq/L	71 neq/L	7.1 neq/L	0.71 neq/L	0.071 neq/L	0.0071 neq/L
OD_{588}	1.375	0.127	0.133	0.128	0.215	0.689	1.175	1.352	1.289	1.273
OD_{588}	1.107	0.141	0.142	0.146	0.267	0.62	1.173	1.178	1.247	1.139
OD_{588}	1.157	0.135	0.136	0.152	0.267	0.64	1.115	1.309	1.396	1.23
OD_{588}	1.302	0.136	0.135	0.139	0.276	0.619	1.225	1.291	1.387	1.215
OD_{588}	1.229	0.126	0.131	0.157	0.272	0.805	1.506	1.446	1.503	1.385
OD_{588}	1.327	0.129	0.134	0.163	0.331	0.809	1.455	1.628	1.712	1.658
Average	1.25	0.132	0.135	0.148	0.271	0.697	1.275	1.367	1.422	1.317
Std Dev	0.104	0.006	0.004	0.013	0.037	0.089	0.164	0.155	0.168	0.186
% Survival	100	0	0.254	1.358	12.443	50.545	102.268	110.548	115.471	106.012
% Std Dev	8.301	0.474	0.301	1.016	2.95	7.116	13.115	12.37	13.434	14.865

Raw data and calculations for daunoform treated MCF-7 cells (3h drug exposure)

	No Drug	Tris Killed	42 µeq/L	4.2 µeq/L	0.42 µeq/L	42 neq/L	4.2 neq/L	0.42 neq/L	0.042 neq/L	0.0042 neq/L
OD_{588}	1.527	0.143	0.143	0.147	0.143	0.291	0.932	1.361	1.32	1.255
OD_{588}	1.322	0.137	0.165	0.171	0.154	0.358	0.895	1.262	1.265	1.167
OD_{588}	1.353	0.138	0.133	0.15	0.154	0.354	1.072	1.326	1.427	1.278
OD_{588}	1.445	0.145	0.138	0.149	0.145	0.353	0.975	1.364	1.551	1.342
OD_{588}	1.347	0.133	0.129	0.145	0.145	0.32	0.993	1.46	1.262	1.501
OD_{588}	1.457	0.124	0.136	0.143	0.14	0.358	1.041	1.63	1.563	2.352
Average	1.409	0.137	0.141	0.151	0.147	0.339	0.985	1.401	1.398	1.483
Std Dev	0.08	0.008	0.013	0.01	0.006	0.028	0.066	0.129	0.137	0.44
% Survival	100	0	0.314	1.114	0.799	15.909	66.675	99.371	99.175	105.819
% Std Dev	5.686	0.536	0.91	0.725	0.415	1.959	4.686	9.193	9.721	31.259



Raw data and calculations for daunomycin treated MCF-7/ADR cells (3h drug exposure)

	No Drug	Tris Killed	71 µeq/L	7.1 µeq/L	0.71 µeq/L	71 neq/L	7.1 neq/L	0.71 neq/L	0.071 neq/L	0.0071 neq/L
OD_{588}	0.548	0.139	0.138	0.203	0.506	0.631	0.613	0.667	0.589	0.608
OD_{588}	0.553	0.146	0.148	0.183	0.505	0.649	0.561	0.577	0.611	0.514
OD_{588}	0.508	0.15	0.139	0.197	0.59	0.625	0.64	0.622	0.695	0.576
OD_{588}	0.611	0.146	0.148	0.196	0.541	0.729	0.718	0.613	0.675	0.683
OD_{588}	0.706	0.148	0.147	0.215	0.663	0.631	0.643	0.763	0.747	0.644
OD_{588}	0.655	0.163	0.184	0.253	0.592	0.771	0.862	1.031	0.812	0.767
Average	0.597	0.149	0.151	0.208	0.566	0.673	0.673	0.712	0.688	0.632
Std Dev	0.074	0.008	0.017	0.024	0.061	0.062	0.106	0.169	0.083	0.088
% Survival	100	0	0.446	13.202	93.157	116.92	116.957	125.734	120.379	107.846
% Std Dev	12.47	1.331	2.839	4.097	10.222	10.369	17.714	28.289	13.98	14.724

Raw data and calculations for daunoform treated MCF-7/ADR cells (3h drug exposure)

	No Drug	Tris Killed	42 µeq/L	4.2 µeq/L	0.42 µeq/L	42 neq/L	4.2 neq/L	0.42 neq/L	0.042 neq/L	0.0042 neq/L
OD_{588}	0.619	0.143	0.144	0.14	0.152	0.171	0.542	0.669	0.67	0.639
OD_{588}	0.671	0.133	0.133	0.131	0.137	0.184	0.51	0.644	0.648	0.675
OD_{588}	0.614	0.144	0.129	0.132	0.138	0.176	0.472	0.63	0.54	0.595
OD_{588}	0.68	0.135	0.139	0.129	0.15	0.172	0.565	0.727	0.648	0.585
OD_{588}	0.656	0.147	0.13	0.153	0.153	0.196	0.585	0.841	0.717	0.746
OD_{588}	0.597	0.174	0.15	0.196	0.171	0.232	0.651	0.741	0.827	0.792
Average	0.64	0.146	0.138	0.147	0.15	0.189	0.554	0.709	0.675	0.672
Std Dev	0.034	0.015	0.008	0.026	0.012	0.023	0.062	0.079	0.094	0.083
% Survival	100	0	-1.723	0.168	0.843	8.611	82.706	114.012	107.19	106.582
% Std Dev	5.317	2.307	1.307	4.012	1.937	3.636	9.714	12.28	14.765	12.984