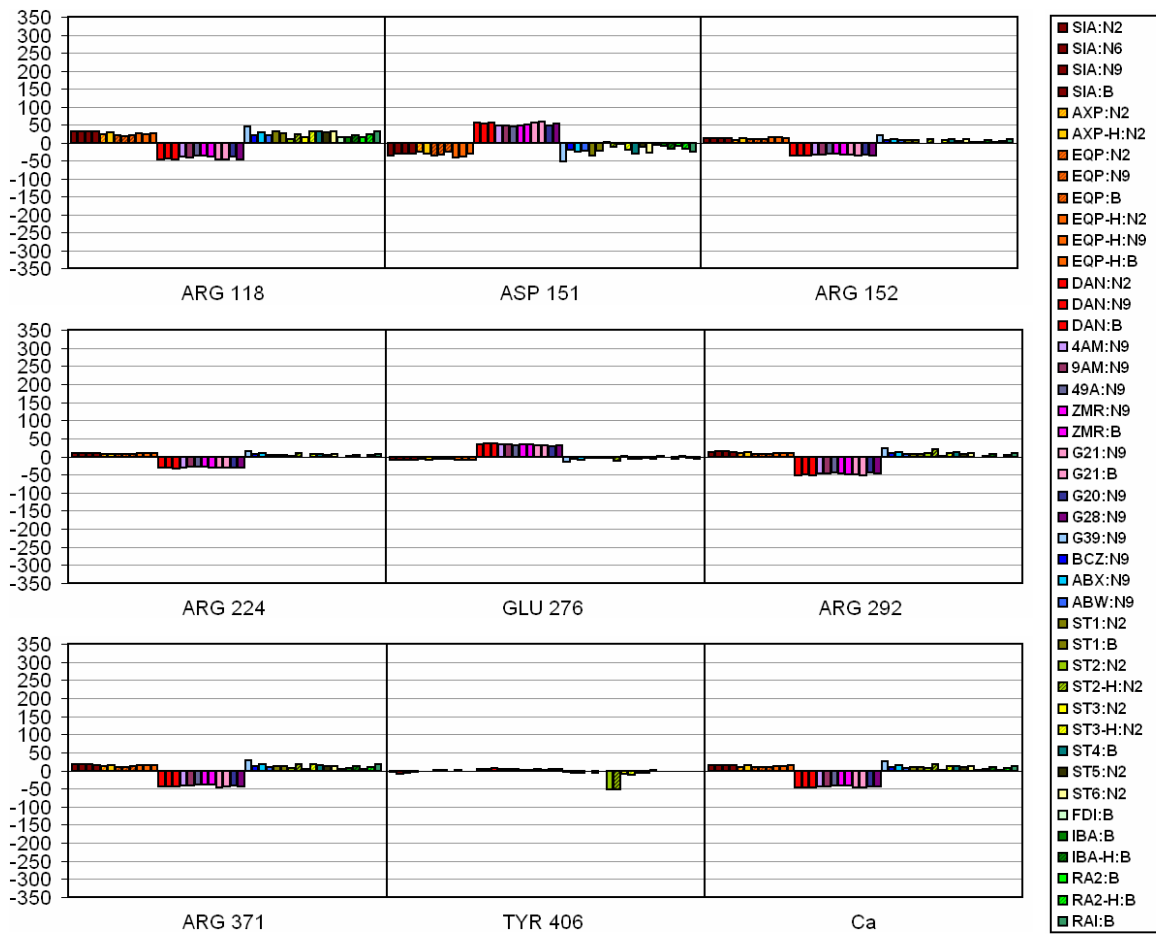
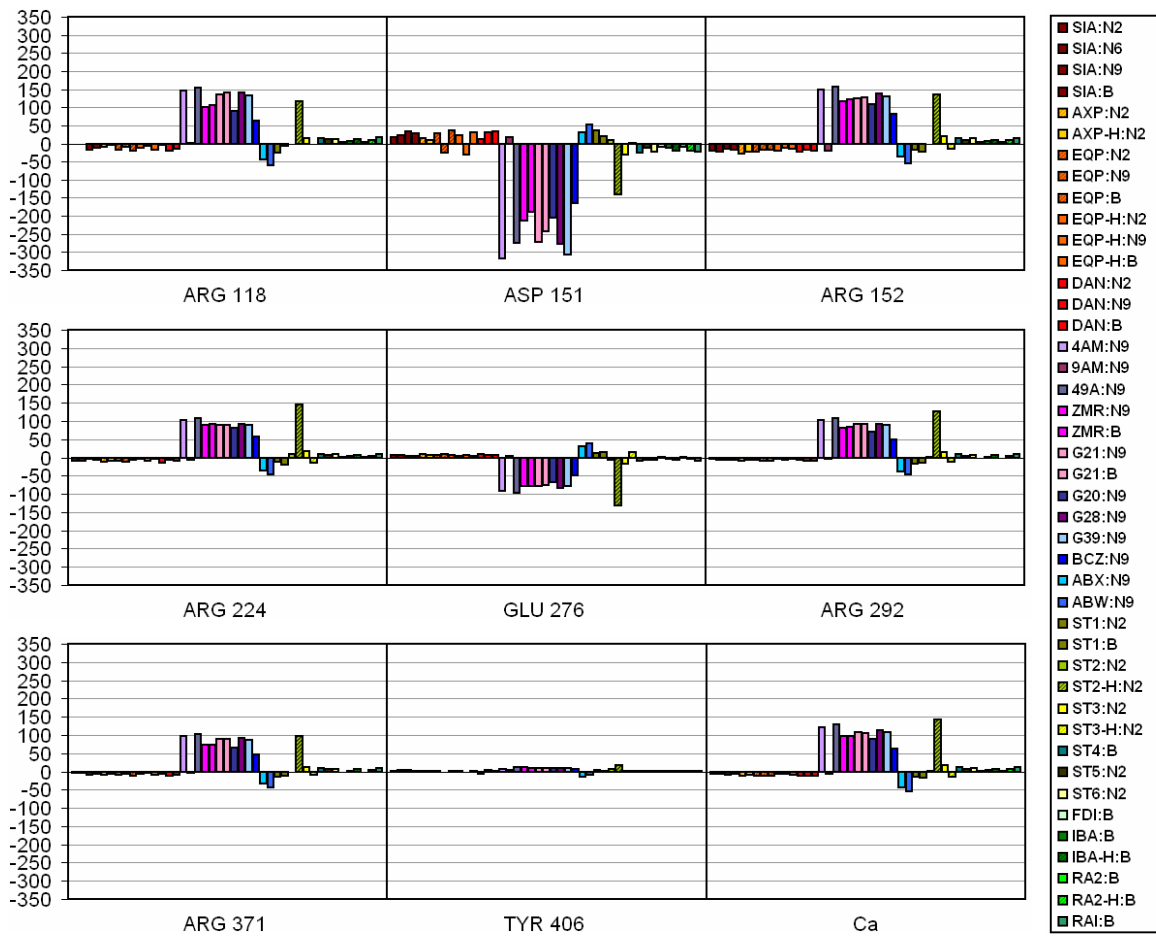


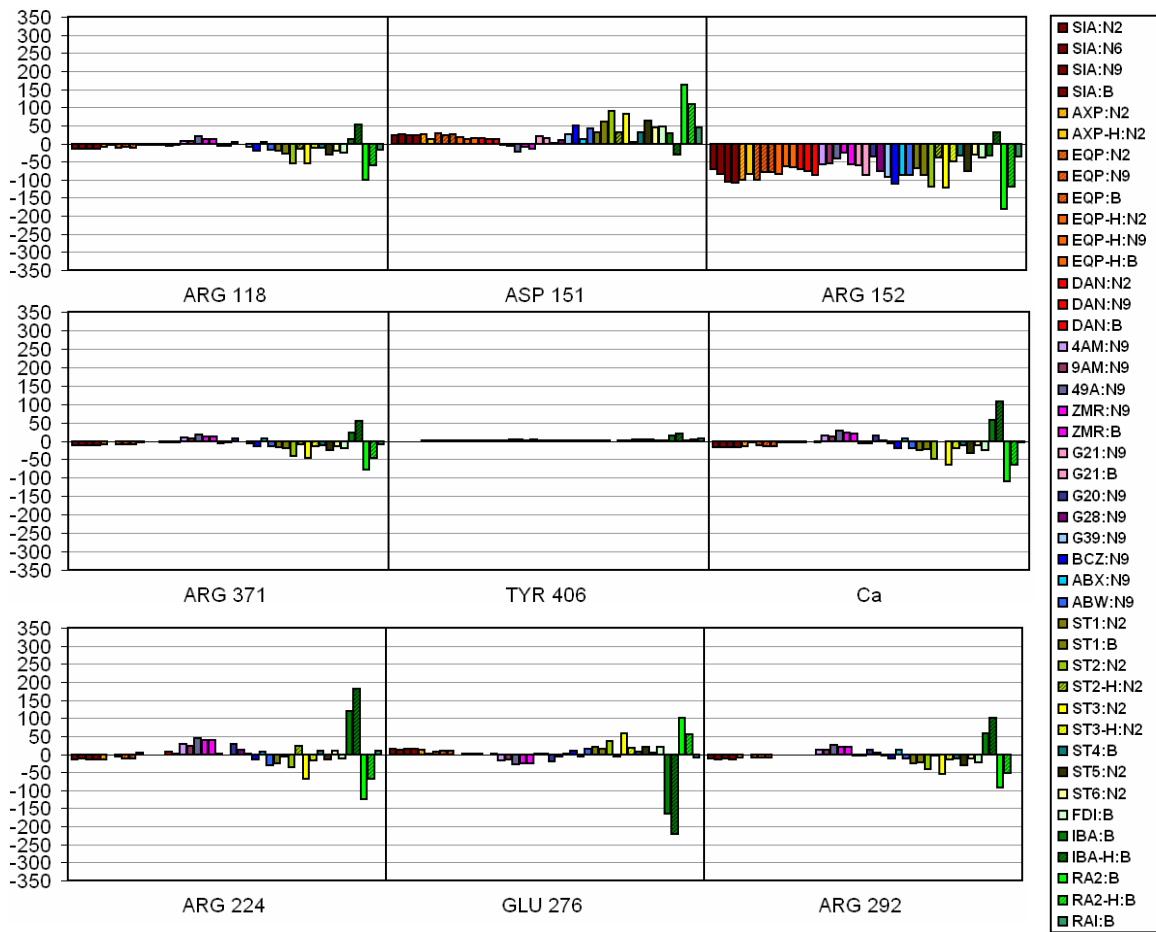
**Figure S1.** Individual contributions from conserved functional residues and calcium ion to electrostatic energies of neuraminidase interaction with the inhibitor C2-group [kJ/mol].



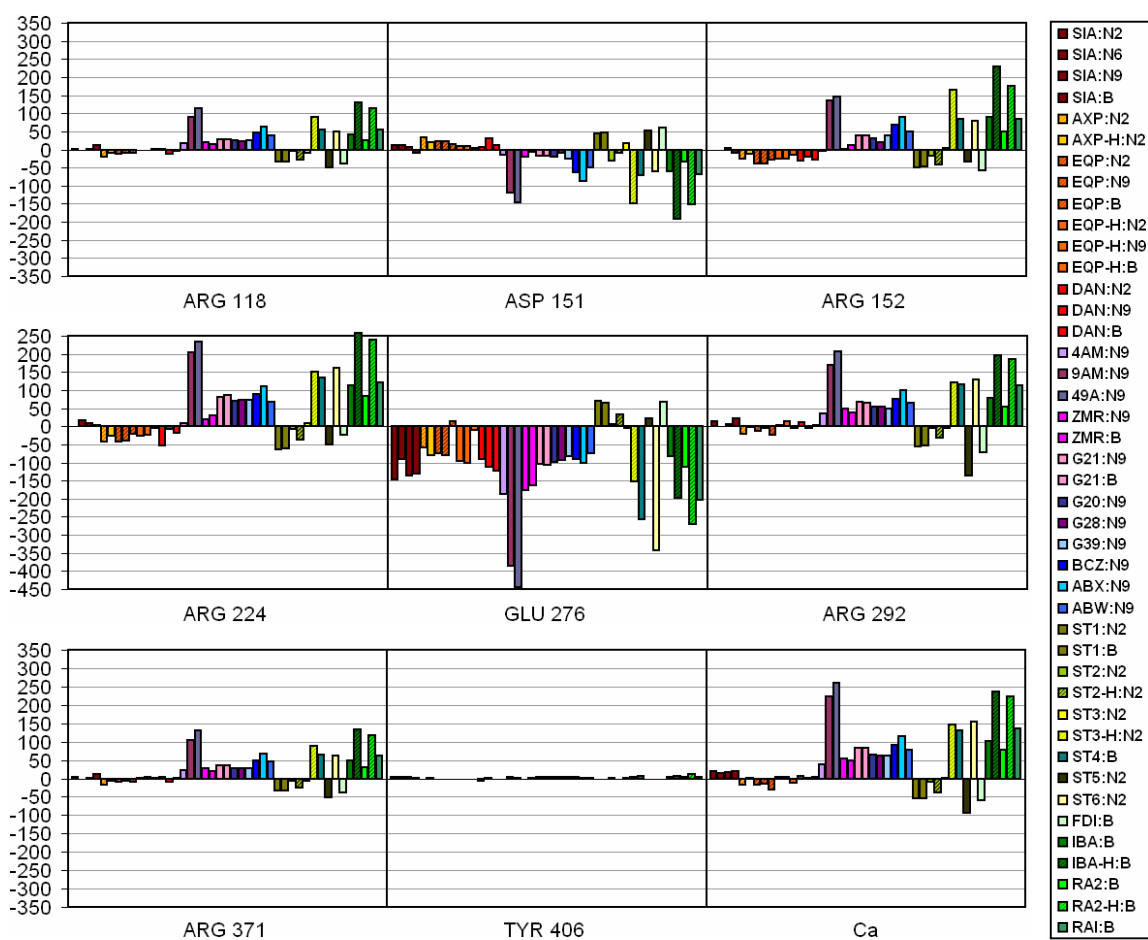
**Figure S2.** Individual contributions from conserved functional residues and calcium ion to electrostatic energies of neuraminidase interaction with the inhibitor C3-group [kJ/mol].



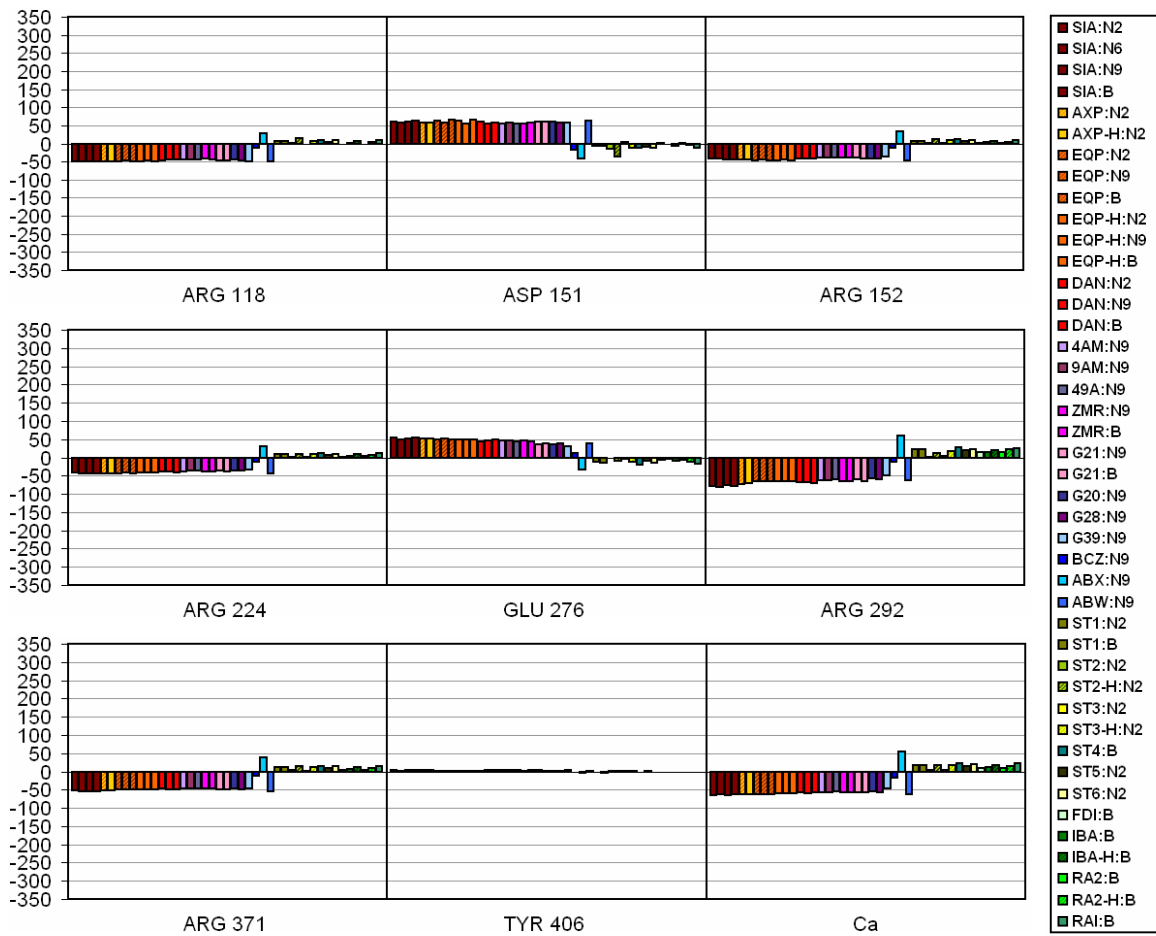
**Figure S3.** Individual contributions from conserved functional residues and the calcium ion to electrostatic energies of neuraminidase interaction with the inhibitor C4-group [kJ/mol].



**Figure S4.** Individual contributions from conserved functional residues and the calcium ion to electrostatic energies of neuraminidase interaction with the inhibitor C5 group [kJ/mol].



**Figure S5.** Individual contributions from conserved functional residues and the calcium ion to electrostatic energies of neuraminidase interaction with the inhibitor C6-group [kJ/mol].



**Figure S6.** Individual contributions from conserved functional residues and the calcium ion to electrostatic energies of neuraminidase interaction with the inhibitor O-group [kJ/mol].

**Table S1.** *Influenza* neuraminidase:inhibitor complexes.

No.	PDB code <sup>a</sup>	Mutation <sup>b</sup>	Protein charge <sup>c</sup>	Inhibitor <sup>d</sup>	Inhibitor charge	pK <sub>i</sub> <sup>exp</sup>	pIC <sub>50</sub> <sup>exp</sup>
1	N2 <sup>e</sup>	2BAT	Asp339Asn	2	SIA	-1	~3.00 <sup>1</sup>
2	N2	1INW		2	AXP	-2	-
3	N2	1INW		2	AXP-H	-1	like SIA <sup>2</sup>
4	N2	1INX		1	EQP	-2	-
5	N2	1INX		1	EQP-H	-1	~4.00 <sup>3</sup>
6	N2	1IVF		1	DAN	-1	5.40, <sup>4</sup> 5.82 <sup>5</sup>
7	N2	1IVD		1	ST1	-1	-
8	N2	1IVC		1	ST2	-1	-
9	N2	1IVC		1	ST2-H	0	<2.00 <sup>7</sup>
10	N2	1IVE		1	ST3	-1	-
11	N2	1IVE		1	ST3-H	0	<2.00 <sup>8</sup>
12	N2	1ING:A		1	ST5	-1	-
13	N2	1ING:B		1	ST5	-1	2.40 <sup>9</sup>
14	N2	1INH:A		1	ST6	0	-
15	N2	1INH:B		1	ST6	0	2.30 <sup>9</sup>
16	N6 <sup>f</sup>	1W1X:A		2	SIA	-1	-
17	N6	1W1X:B		3	SIA	-1	-
18	N6	1W1X:C		3	SIA	-1	-
19	N6	1W1X:D		2	SIA	-1	-
20	N6	1W20:A		2	SIA	-1	-
21	N6	1W20:B		2	SIA	-1	-
22	N6	1W20:C		2	SIA	-1	-
23	N6	1W20:D		2	SIA	-1	-
24	N6	1W21:A		2	SIA	-1	-
25	N6	1W21:B		2	SIA	-1	-
26	N6	1W21:C		2	SIA	-1	-
27	N6	1W21:D		2	SIA	-1	-
28	N9 <sup>g</sup>	1MWE		-1	SIA	-1	4.26 <sup>10</sup>
29	N9	2QWB	Arg292Lys <sup>h</sup>	-1	SIA	-1	2.74 <sup>11</sup>
30	N9	1INY	Ser370Leu	-1	EQP	-2	-
31	N9	1INY	Ser370Leu	-1	EQP-H	-1	~3.00 <sup>12</sup>
32	N9	1F8B		-1	DAN	-1	5.30, <sup>13</sup> 5.58 <sup>14</sup>
33	N9	1NNB		-1	DAN	-1	-
34	N9	2QWC	Arg292Lys <sup>h</sup>	-1	DAN	-1	3.55 <sup>15</sup>
35	N9	1F8C		-1	4AM	0	6.83, <sup>16</sup> 7.40, <sup>17</sup> 7.41 <sup>18</sup>
36	N9	2QWD	Arg292Lys <sup>h</sup>	-1	4AM	0	4.85 <sup>19</sup>
37	N9	1F8D		-1	9AM	0	3.40 <sup>20</sup>
38	N9	1F8E		-1	49A	1	4.82 <sup>21</sup>
39	N9	1NNC		-1	ZMR	0	8.71, <sup>22</sup> 8.89, <sup>23</sup> 9.19 <sup>18</sup>
40	N9	2QWE	Arg292Lys <sup>h</sup>	-1	ZMR	0	7.48 <sup>24</sup>
41	N9	1BJI		0	G21	0	9.19 <sup>18</sup>
42	N9	2QWF	Arg292Lys <sup>h</sup>	0	G20	0	5.67 <sup>25</sup>
43	N9	2QWI		0	G20	0	8.36, <sup>26</sup> 9.28 <sup>18</sup>
44	N9	2QWG	Arg292Lys <sup>h</sup>	0	G28	0	-
45	N9	2QWJ		-1	G28	0	9.41 <sup>18</sup>
46	N9	2QWH	Arg292Lys <sup>h</sup>	-1	G39	0	-
							<4.52, <sup>29</sup> 4.89 <sup>30</sup>

47	N9	2QWK		0	G39	0	9.96 <sup>31</sup>	8.70, <sup>32</sup> 9.10 <sup>33</sup>
48	N9	1L7F		0	BCZ	0	10.82 <sup>34</sup>	
49	N9	1L7G	Glu119Gly <sup>h</sup>	1	BCZ	0	-	
50	N9	1L7H	Arg292Lys <sup>h</sup>	0	BCZ	0	-	
51	N9	1XOE		-1	ABX	0	6.82, <sup>35</sup> 7.43 <sup>36</sup>	7.39 <sup>37</sup>
52	N9	1XOG		-1	ABW	-1	-	6.39 <sup>38</sup>
53	B/B <sup>i</sup>	1NSC:A		4	SIA	-1	-	<2.00, <sup>39</sup> 3.00 <sup>40</sup>
54	B/B	1NSC:B		4	SIA	-1		
55	B/L <sup>j</sup>	1INV		3	EQP	-2	-	~4.00 <sup>41</sup>
56	B/L	1INV		3	EQP-H	-1		
57	B/B	1NSD:A		4	DAN	-1	-	4.82 <sup>9</sup>
58	B/B	1NSD:B		4	DAN	-1		
59	B/B	1A4G:A		4	ZMR	0	8.85 <sup>42</sup>	
60	B/B	1A4G:B		4	ZMR	0		
61	B/B	1A4Q:A		4	G21	0	-	5.07 <sup>42</sup>
62	B/B	1A4Q:B		4	G21	0		
63	B/L	1IVB		3	ST1	-1	-	3.12 <sup>43</sup>
64	B/L	1INF	Arg382Lys	3	ST4	0	-	5.00 <sup>9</sup>
65	B/L	1B9S		4	FDI	-1	-	<3.18 <sup>44,45</sup>
66	B/L	1VCJ		3	IBA	0	-	4.59 <sup>46</sup>
67	B/L	1VCJ		3	IBA-H	1		
68	B/L	1B9V		4	RA2	-1	-	3.57, <sup>47</sup> 3.65, <sup>48</sup> 3.98 <sup>49</sup>
69	B/L	1B9V		4	RA2-H	0		
70	B/L	1B9T		3	RAI	0	-	5.10 <sup>50,49</sup>

<sup>a</sup> Chain identifier is denoted after colon.

<sup>b</sup> Residue numbers like in original PDB structures.

<sup>c</sup> The charge of polipeptide chain plus calcium ion.

<sup>d</sup> Inhibitors and their protonation state used in calculations are shown in **Scheme 1**.

<sup>f</sup> A/Tokyo/3/67 (H2N2)

<sup>e</sup> A/duck/England/56(H11N6)

<sup>g</sup> A/tern.Australia/G70C/75 (H11N9)

<sup>h</sup> Mutation in active site

<sup>i</sup> B/Beijing/1/87

<sup>j</sup> B/Lee/40

## References

- <sup>1</sup> von Itzstein, M.; Dyason, J. C.; Oliver, S. W.; White, H. F.; Wu, W. Y.; Kok, G. B.; Pegg, M. S. A study of the active site of influenza virus sialidase: an approach to the rational design of novel anti-influenza drugs. *J. Med. Chem.* **1996**, *39*, 388-391.
- <sup>2</sup> White, C. L.; Janakiraman, M. N.; Laver, W. G.; Philippon, C.; Vasella, A.; Air, G. M.; Luo, M. A sialic acid-derived phosphonate analog inhibits different strains of influenza virus neuraminidase with different efficiencies. *J. Mol. Biol.* **1995** *245*, 623-634.
- <sup>3</sup> White, C. L.; Janakiraman, M. N.; Laver, W. G.; Philippon, C.; Vasella, A.; Air, G. M.; Luo, M. A sialic acid-derived phosphonate analog inhibits different strains of influenza virus neuraminidase with different efficiencies. *J. Mol. Biol.* **1995** *245*, 623-634.
- <sup>4</sup> Taylor, N. R.; von Itzstein, M. Molecular Modeling Studies on Ligand Binding to Sialidase from Influenza Virus and the Mechanism of Catalysis. *J. Med. Chem.* **1994**, *37*, 616-624.
- <sup>5</sup> Stoll, V.; Stewart, K. D.; Maring, C. J.; Muchmore, S.; Giranda, V.; Gu, Y. G.; Wang, G.; Chen, Y.; Sun, M.; Zhao, C.; Kennedy, A. L.; Madigan, D. L.; Xu, Y.; Saldivar, A.; Kati, W.; Laver, G.; Sowin, T.;



- 
- Sham, H. L.; Greer, J.; Kempf, D. Influenza neuraminidase inhibitors: structure-based design of a novel inhibitor series. *Biochemistry* **2003**, *42*, 718-727.
- <sup>6</sup> Jedrzejewski, M. J.; Singh, S.; Brouillette, W. J.; Laver, W. G.; Air, G. M.; Luo, M. Structures of aromatic inhibitors of influenza virus neuraminidase. *Biochemistry* **1995**, *34*, 3144-3151.
- <sup>7</sup> Jedrzejewski, M. J.; Singh, S.; Brouillette, W. J.; Laver, W. G.; Air, G. M.; Luo, M. Structures of aromatic inhibitors of influenza virus neuraminidase. *Biochemistry* **1995**, *34*, 3144-3151.
- <sup>8</sup> Jedrzejewski, M. J.; Singh, S.; Brouillette, W. J.; Laver, W. G.; Air, G. M.; Luo, M. Structures of aromatic inhibitors of influenza virus neuraminidase. *Biochemistry* **1995**, *34*, 3144-3151.
- <sup>9</sup> Singh, S.; Jedrzejewski, M. J.; Air, G. M.; Luo, M.; Laver, W. G.; Brouillette, W. J. Structure-based inhibitors of influenza virus sialidase. A benzoic acid lead with novel interaction. *J. Med. Chem.* **1995**, *38*, 3217-3225.
- <sup>10</sup> Varghese, J. N.; Smith, P. W.; Sollis, S. L.; Blick, T. J.; Sahasrabudhe, A.; McKimm-Breschkin, J. L.; Colman, P. M. Drug design against a shifting target: a structural basis for resistance to inhibitors in a variant of influenza virus neuraminidase. *Structure* **1998**, *6*, 735-746.
- <sup>11</sup> Varghese, J. N.; Smith, P. W.; Sollis, S. L.; Blick, T. J.; Sahasrabudhe, A.; McKimm-Breschkin, J. L.; Colman, P. M. Drug design against a shifting target: a structural basis for resistance to inhibitors in a variant of influenza virus neuraminidase. *Structure* **1998**, *6*, 735-746.
- <sup>12</sup> White, C. L.; Janakiraman, M. N.; Laver, W. G.; Philippon, C.; Vasella, A.; Air, G. M.; Luo, M. A sialic acid-derived phosphonate analog inhibits different strains of influenza virus neuraminidase with different efficiencies. *J. Mol. Biol.* **1995**, *245*, 623-634.
- <sup>13</sup> Mann, M. C.; Islam, T.; Dyason, J. C.; Florio, P.; Trower, C. J.; Thomson, R. J.; von Itzstein, M. Unsaturated N-acetyl- D-glucosaminuronic acid glycosides as inhibitors of influenza virus sialidase. *Glycoconj. J.* **2006**, *23*, 127-133.
- <sup>14</sup> McKimm-Breschkin, J.L.; Sahasrabudhe, A.; Blick, T.J.; McDonald, M.; Colman, P. M.; Hart, G. J.; Bethell, R. C.; Varghese, J. N. Mutations in a conserved residue in the influenza virus neuraminidase active site decreases sensitivity to Neu5Ac2en-derived inhibitors. *J. Vir.* **1998**, *72*, 2456-2462.
- <sup>15</sup> McKimm-Breschkin, J.L.; Sahasrabudhe, A.; Blick, T.J.; McDonald, M.; Colman, P. M.; Hart, G. J.; Bethell, R. C.; Varghese, J. N. Mutations in a conserved residue in the influenza virus neuraminidase active site decreases sensitivity to Neu5Ac2en-derived inhibitors. *J. Vir.* **1998**, *72*, 2456-2462.
- <sup>16</sup> McKimm-Breschkin, J.L.; Sahasrabudhe, A.; Blick, T.J.; McDonald, M.; Colman, P. M.; Hart, G. J.; Bethell, R. C.; Varghese, J. N. Mutations in a conserved residue in the influenza virus neuraminidase active site decreases sensitivity to Neu5Ac2en-derived inhibitors. *J. Vir.* **1998**, *72*, 2456-2462.
- <sup>17</sup> Smith, B. J.; Colman, P. M.; von Itzstein, M.; Danyelec, B.; Varghese, J. N. Analysis of inhibitor binding in influenza virus neuraminidase. *Protein. Sci.* **2001**, *10*, 689-696.
- <sup>18</sup> Smith, P. W.; Sollis, S. L.; Howes, P. D.; Cherry, P. C.; Cobley, K. N.; Taylor, H.; Whittington, A. R.; Scicinski, J.; Bethell, R. C.; Taylor, N.; Skarzynski, T.; Cleasby, A.; Singh, O.; Wonacott, A.; Varghese, J.; Colman, P. Novel inhibitors of influenza sialidases related to GG167 structure-activity, crystallographic and Molecular dynamics studies with 4H-pyran-2-carboxylic acid 6-carboxamides. *Bioorg. Med. Chem. Lett.* **1996**, *6*, 2931-2936.
- <sup>19</sup> McKimm-Breschkin, J.L.; Sahasrabudhe, A.; Blick, T.J.; McDonald, M.; Colman, P. M.; Hart, G. J.; Bethell, R. C.; Varghese, J. N. Mutations in a conserved residue in the influenza virus neuraminidase active site decreases sensitivity to Neu5Ac2en-derived inhibitors. *J. Vir.* **1998**, *72*, 2456-2462.
- <sup>20</sup> Smith, B. J.; Colman, P. M.; von Itzstein, M.; Danyelec, B.; Varghese, J. N. Analysis of inhibitor binding in influenza virus neuraminidase. *Protein. Sci.* **2001**, *10*, 689-696.
- <sup>21</sup> Smith, B. J.; Colman, P. M.; von Itzstein, M.; Danyelec, B.; Varghese, J. N. Analysis of inhibitor binding in influenza virus neuraminidase. *Protein. Sci.* **2001**, *10*, 689-696.

- 
- <sup>22</sup> McKimm-Breschkin, J.L.; Sahasrabudhe, A.; Blick, T.J.; McDonald, M.; Colman, P. M.; Hart, G. J.; Bethell, R. C.; Varghese, J. N. Mutations in a conserved residue in the influenza virus neuraminidase active site decreases sensitivity to Neu5Ac2en-derived inhibitors. *J. Vir.* **1998**, *72*, 2456–2462.
- <sup>23</sup> Kati, W. M.; Montgomery, D.; Carrick, R.; Gubareva, L.; Maring, C.; McDaniel, K.; Steffy, K.; Molla, A.; Hayden, F.; Kempf, D.; Kohlbrenner, W. In vitro characterization of A-315675, a highly potent inhibitor of A and B strain influenza virus neuraminidases and influenza virus replication. *Antimicrob. Agents Chemother.* **2002**, *46*, 1014–1021.
- <sup>24</sup> McKimm-Breschkin, J.L.; Sahasrabudhe, A.; Blick, T.J.; McDonald, M.; Colman, P. M.; Hart, G. J.; Bethell, R. C.; Varghese, J. N. Mutations in a conserved residue in the influenza virus neuraminidase active site decreases sensitivity to Neu5Ac2en-derived inhibitors. *J. Vir.* **1998**, *72*, 2456–2462.
- <sup>25</sup> McKimm-Breschkin, J.L.; Sahasrabudhe, A.; Blick, T.J.; McDonald, M.; Colman, P. M.; Hart, G. J.; Bethell, R. C.; Varghese, J. N. Mutations in a conserved residue in the influenza virus neuraminidase active site decreases sensitivity to Neu5Ac2en-derived inhibitors. *J. Vir.* **1998**, *72*, 2456–2462.
- <sup>26</sup> McKimm-Breschkin, J.L.; Sahasrabudhe, A.; Blick, T.J.; McDonald, M.; Colman, P. M.; Hart, G. J.; Bethell, R. C.; Varghese, J. N. Mutations in a conserved residue in the influenza virus neuraminidase active site decreases sensitivity to Neu5Ac2en-derived inhibitors. *J. Vir.* **1998**, *72*, 2456–2462.
- <sup>27</sup> Varghese, J. N.; Smith, P. W.; Sollis, S. L.; Blick, T. J.; Sahasrabudhe, A.; McKimm-Breschkin, J. L.; Colman, P. M. Drug design against a shifting target: a structural basis for resistance to inhibitors in a variant of influenza virus neuraminidase. *Structure* **1998**, *6*, 735–746.
- <sup>28</sup> Varghese, J. N.; Smith, P. W.; Sollis, S. L.; Blick, T. J.; Sahasrabudhe, A.; McKimm-Breschkin, J. L.; Colman, P. M. Drug design against a shifting target: a structural basis for resistance to inhibitors in a variant of influenza virus neuraminidase. *Structure* **1998**, *6*, 735–746.
- <sup>29</sup> Yen, H. L.; Herlocher, L. M.; Hoffmann, E.; Matrosovich, M. N.; Monto, A. S.; Webster, R. G.; Govorkova, E. A. Neuraminidase inhibitor-resistant influenza viruses may differ substantially in fitness and transmissibility. *Antimicrob. Agents Chemother.* **2005**, *49*, 4075–4084.
- <sup>30</sup> Varghese, J. N.; Smith, P. W.; Sollis, S. L.; Blick, T. J.; Sahasrabudhe, A.; McKimm-Breschkin, J. L.; Colman, P. M. Drug design against a shifting target: a structural basis for resistance to inhibitors in a variant of influenza virus neuraminidase. *Structure* **1998**, *6*, 735–746.
- <sup>31</sup> Kati, W. M.; Montgomery, D.; Carrick, R.; Gubareva, L.; Maring, C.; McDaniel, K.; Steffy, K.; Molla, A.; Hayden, F.; Kempf, D.; Kohlbrenner, W. In vitro characterization of A-315675, a highly potent inhibitor of A and B strain influenza virus neuraminidases and influenza virus replication. *Antimicrob. Agents Chemother.* **2002**, *46*, 1014–1021.
- <sup>32</sup> Varghese, J. N.; Smith, P. W.; Sollis, S. L.; Blick, T. J.; Sahasrabudhe, A.; McKimm-Breschkin, J. L.; Colman, P. M. Drug design against a shifting target: a structural basis for resistance to inhibitors in a variant of influenza virus neuraminidase. *Structure* **1998**, *6*, 735–746.
- <sup>33</sup> Yen, H. L.; Herlocher, L. M.; Hoffmann, E.; Matrosovich, M. N.; Monto, A. S.; Webster, R. G.; Govorkova, E. A. Neuraminidase inhibitor-resistant influenza viruses may differ substantially in fitness and transmissibility. *Antimicrob. Agents Chemother.* **2005**, *49*, 4075–4084.
- <sup>34</sup> Kati, W. M.; Montgomery, D.; Carrick, R.; Gubareva, L.; Maring, C.; McDaniel, K.; Steffy, K.; Molla, A.; Hayden, F.; Kempf, D.; Kohlbrenner, W. In vitro characterization of A-315675, a highly potent inhibitor of A and B strain influenza virus neuraminidases and influenza virus replication. *Antimicrob. Agents Chemother.* **2002**, *46*, 1014–1021.
- <sup>35</sup> Maring, C. J.; Stoll, V. S.; Zhao, C.; Sun, M.; Krueger, A. C.; Stewart, K. D.; Madigan, D. L.; Kati, W. M.; Xu, Y.; Carrick, R. J.; Montgomery, D. A.; Kempf-Grote, A.; Marsh, K. C.; Molla, A.; Steffy, K. R.; Sham, H. L.; Laver, W. G.; Gu, Y. G.; Kempf, D. J.; Kohlbrenner, W. E. Structure-based characterization and optimization of novel hydrophobic binding interactions in a series of pyrrolidine influenza neuraminidase inhibitors. *J. Med. Chem.* **2005**, *48*, 3980–3990.

- 
- <sup>36</sup> Stoll, V.; Stewart, K. D.; Maring, C. J.; Muchmore, S.; Giranda, V.; Gu, Y. G.; Wang, G.; Chen, Y.; Sun, M.; Zhao, C.; Kennedy, A. L.; Madigan, D. L.; Xu, Y.; Saldivar, A.; Kati, W.; Laver, G.; Sowin, T.; Sham, H. L.; Greer, J.; Kempf, D. Influenza neuraminidase inhibitors: structure-based design of a novel inhibitor series. *Biochemistry* **2003**, *42*, 718-727.
- <sup>37</sup> Wang, G. T.; Wang, S.; Gentles, R.; Sowin, T.; Maring, C. J.; Kempf, D. J.; Kati, W. M.; Stoll, V.; Stewart, K. D.; Laver, G. Design, synthesis, and structural analysis of inhibitors of influenza neuraminidase containing a 2,3-disubstituted tetrahydrofuran-5-carboxylic acid core. *Bioorg. Med. Chem. Lett.* **2005**, *15*, 125-128.
- <sup>38</sup> Wang, G. T.; Wang, S.; Gentles, R.; Sowin, T.; Maring, C. J.; Kempf, D. J.; Kati, W. M.; Stoll, V.; Stewart, K. D.; Laver, G. Design, synthesis, and structural analysis of inhibitors of influenza neuraminidase containing a 2,3-disubstituted tetrahydrofuran-5-carboxylic acid core. *Bioorg. Med. Chem. Lett.* **2005**, *15*, 125-128.
- <sup>39</sup> Jedrzejewski, M. J.; Singh, S.; Brouillette, W. J.; Laver, W. G.; Air, G. M.; Luo, M. Structures of aromatic inhibitors of influenza virus neuraminidase. *Biochemistry* **1995**, *34*, 3144-3151.
- <sup>40</sup> Taylor, N. R.; Cleasby, A.; Singh, O.; Skarzynski, T.; Wonacott, A. J.; Smith, P. W.; Sollis, S. L.; Howes, P. D.; Cherry, P. C.; Bethell, R.; Colman, P.; Varghese, J. Dihydropyranocarboxamides related to zanamivir: a new series of inhibitors of influenza virus sialidases. 2. Crystallographic and molecular modeling study of complexes of 4-amino-4H-pyran-6-carboxamides and sialidase from influenza virus types A and B. *J. Med. Chem.* **1998**, *41*, 798-807.
- <sup>41</sup> White, C. L.; Janakiraman, M. N.; Laver, W. G.; Philippon, C.; Vasella, A.; Air, G. M.; Luo, M. A sialic acid-derived phosphonate analog inhibits different strains of influenza virus neuraminidase with different efficiencies. *J. Mol. Biol.* **1995**, *245*, 623-634.
- <sup>42</sup> Smith, P. W.; Sollis, S. L.; Howes, P. D.; Cherry, P. C.; Starkey, I. D.; Cobley, K. N.; Weston, H.; Scicinski, J.; Merritt, A.; Whittington, A.; Wyatt, P.; Taylor, N.; Green, D.; Bethell, R.; Madar, S.; Fenton, R. J.; Morley, P. J.; Pateman, T.; Beresford, A. Dihydropyranocarboxamides related to zanamivir: a new series of inhibitors of influenza virus sialidases. 1. Discovery, synthesis, biological activity, and structure-activity relationships of 4-guanidino- and 4-amino-4H-pyran-6-carboxamides. *J. Med. Chem.* **1998**, *41*, 787-797.
- <sup>43</sup> Jedrzejewski, M. J.; Singh, S.; Brouillette, W. J.; Laver, W. G.; Air, G. M.; Luo, M. Structures of aromatic inhibitors of influenza virus neuraminidase. *Biochemistry* **1995**, *34*, 3144-3151.
- <sup>44</sup> Finley, J. B.; Atigadda, V. R.; Duarte, F.; Zhao, J. J.; Brouillette, W. J.; Air, G. M.; Luo, M. Novel aromatic inhibitors of influenza virus neuraminidase make selective interactions with conserved residues and water molecules in the active site. *J. Mol. Biol.* **1999**, *293*, 1107-1119.
- <sup>45</sup> Atigadda, V. R.; Brouillette, W. J.; Duarte, F.; Babu, Y. S.; Bantia, S.; Chand, P.; Chu, N.; Montgomery, J. A.; Walsh, D. A.; Sudbeck, E.; Finley, J.; Air, G. M.; Luo, M.; Laver, G. W. Hydrophobic benzoic acids as inhibitors of influenza neuraminidase. *Bioorg. Med. Chem.* **1999**, *7*, 2487-2497.
- <sup>46</sup> Lommer, B. S.; Ali, S. M.; Bajpai, S. N.; Brouillette, W. J.; Air, G. M.; Luo, M. A benzoic acid inhibitor induces a novel conformational change in the active site of Influenza B virus neuraminidase. *Acta Crystallogr.* **2004**, *D60*, 1017-1023.
- <sup>47</sup> Lommer, B. S.; Ali, S. M.; Bajpai, S. N.; Brouillette, W. J.; Air, G. M.; Luo, M. A benzoic acid inhibitor induces a novel conformational change in the active site of Influenza B virus neuraminidase. *Acta Crystallogr.* **2004**, *D60*, 1017-1023.
- <sup>48</sup> Finley, J. B.; Atigadda, V. R.; Duarte, F.; Zhao, J. J.; Brouillette, W. J.; Air, G. M.; Luo, M. Novel aromatic inhibitors of influenza virus neuraminidase make selective interactions with conserved residues and water molecules in the active site. *J. Mol. Biol.* **1999**, *293*, 1107-1119.
- <sup>49</sup> Atigadda, V. R.; Brouillette, W. J.; Duarte, F.; Ali, S. M.; Babu, Y. S.; Bantia, S.; Chand, P.; Chu, N.; Montgomery, J. A.; Walsh, D. A.; Sudbeck, E. A.; Finley, J.; Luo, M.; Air, G. M.; Laver, G. W.

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Potent inhibition of influenza sialidase by a benzoic acid containing a 2-pyrrolidinone substituent. *J. Med. Chem.* **1999**, *42*, 2332–2343.

- <sup>50</sup> Finley, J. B.; Atigadda, V. R.; Duarte, F.; Zhao, J. J.; Brouillette, W. J.; Air, G. M.; Luo, M. Novel aromatic inhibitors of influenza virus neuraminidase make selective interactions with conserved residues and water molecules in the active site. *J. Mol. Biol.* **1999**, *293*, 1107–1119.

## Tables S2-S3

Residues flipped by reduce

No.	PDB Code	Residue Name	Residue Number
1	2BAT	ASN	104
1	2BAT	ASN	142
1	2BAT	ASN	161
1	2BAT	ASN	334
1	2BAT	ASN	356
1	2BAT	ASN	387
1	2BAT	ASN	393
1	2BAT	ASN	419
1	2BAT	GLN	131
1	2BAT	GLN	226
1	2BAT	HIS	168
1	2BAT	HIS	274
2	1INW	ASN	142
2	1INW	ASN	334
2	1INW	ASN	356
2	1INW	ASN	358
2	1INW	ASN	387
2	1INW	ASN	393
2	1INW	ASN	419
2	1INW	GLN	131
2	1INW	GLN	226
2	1INW	HIS	155
2	1INW	HIS	168
2	1INW	HIS	184
2	1INW	HIS	274
3	1INW	ASN	142
3	1INW	ASN	334
3	1INW	ASN	356
3	1INW	ASN	358
3	1INW	ASN	387
3	1INW	ASN	393
3	1INW	ASN	419
3	1INW	GLN	131
3	1INW	GLN	226
3	1INW	HIS	155
3	1INW	HIS	168
3	1INW	HIS	184
3	1INW	HIS	274
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4	1INX	ASN	142
4	1INX	ASN	161
4	1INX	ASN	334
4	1INX	ASN	356
4	1INX	ASN	387
4	1INX	ASN	393
4	1INX	ASN	419

4	1INX	GLN	131
4	1INX	GLN	226
4	1INX	HIS	168
4	1INX	HIS	184
4	1INX	HIS	274
5	1INX	ASN	104
5	1INX	ASN	142
5	1INX	ASN	161
5	1INX	ASN	334
5	1INX	ASN	356
5	1INX	ASN	387
5	1INX	ASN	393
5	1INX	ASN	419
5	1INX	GLN	131
5	1INX	GLN	226
5	1INX	HIS	168
5	1INX	HIS	184
5	1INX	HIS	274
6	1IVF	ASN	104
6	1IVF	ASN	142
6	1IVF	ASN	161
6	1IVF	ASN	334
6	1IVF	ASN	356
6	1IVF	ASN	358
6	1IVF	ASN	387
6	1IVF	ASN	393
6	1IVF	GLN	136
6	1IVF	GLN	220
6	1IVF	GLN	226
6	1IVF	HIS	168
6	1IVF	HIS	184
6	1IVF	HIS	274
7	1IVD	ASN	104
7	1IVD	ASN	161
7	1IVD	ASN	334
7	1IVD	ASN	387
7	1IVD	ASN	393
7	1IVD	ASN	402
7	1IVD	ASN	419
7	1IVD	GLN	131
7	1IVD	GLN	173
7	1IVD	GLN	226
7	1IVD	HIS	150
8	1IVC	ASN	104
8	1IVC	ASN	142
8	1IVC	ASN	334
8	1IVC	ASN	387
8	1IVC	ASN	393
8	1IVC	ASN	402
8	1IVC	ASN	419

8	1IVC	GLN	131
8	1IVC	GLN	226
8	1IVC	HIS	155
8	1IVC	HIS	184
8	1IVC	HIS	274
9	1IVC	ASN	104
9	1IVC	ASN	142
9	1IVC	ASN	334
9	1IVC	ASN	387
9	1IVC	ASN	393
9	1IVC	ASN	402
9	1IVC	ASN	419
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9	1IVC	GLN	226
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9	1IVC	HIS	184
9	1IVC	HIS	274
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10	1IVE	ASN	402
10	1IVE	ASN	419
10	1IVE	GLN	131
10	1IVE	GLN	220
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11	1IVE	ASN	161
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11	1IVE	ASN	402
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11	1IVE	HIS	168
11	1IVE	HIS	184
11	1IVE	HIS	274
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12	1ING	ASN	465
12	1ING	GLN	173
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13	1ING	ASN	104
13	1ING	ASN	161
13	1ING	ASN	221
13	1ING	ASN	334
13	1ING	ASN	387
13	1ING	ASN	402
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13	1ING	GLN	173
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13	1ING	HIS	264
13	1ING	HIS	274
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14	1INH	ASN	142
14	1INH	ASN	387
14	1INH	ASN	393
14	1INH	ASN	402
14	1INH	ASN	419
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14	1INH	GLN	226
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15	1INH	ASN	387
15	1INH	ASN	393
15	1INH	ASN	419
15	1INH	ASN	465
15	1INH	ASN	465
15	1INH	GLN	131
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15	1INH	HIS	274
16	1W1X	ASN	92
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16	1W1X	ASN	340
16	1W1X	ASN	342
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16	1W1X	ASN	406
16	1W1X	ASN	408
16	1W1X	ASN	422
16	1W1X	ASN	427
16	1W1X	ASN	449
16	1W1X	GLN	233
16	1W1X	HIS	119
16	1W1X	HIS	150
16	1W1X	HIS	240



16	1W1X	HIS	281
16	1W1X	HIS	467
17	1W1X	ASN	1152
17	1W1X	ASN	1207
17	1W1X	ASN	1340
17	1W1X	ASN	1342
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17	1W1X	ASN	1405
17	1W1X	ASN	1406
17	1W1X	ASN	1408
17	1W1X	ASN	1427
17	1W1X	ASN	1449
17	1W1X	GLN	1142
17	1W1X	GLN	1233
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17	1W1X	HIS	1240
17	1W1X	HIS	1281
17	1W1X	HIS	1467
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18	1W1X	ASN	2207
18	1W1X	ASN	2340
18	1W1X	ASN	2406
18	1W1X	ASN	2408
18	1W1X	ASN	2422
18	1W1X	ASN	2449
18	1W1X	GLN	2233
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18	1W1X	HIS	2467
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19	1W1X	ASN	3400
19	1W1X	ASN	3406
19	1W1X	ASN	3422
19	1W1X	ASN	3427
19	1W1X	ASN	3449
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20	1W20	ASN	342
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24	1W21	ASN	342
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24	1W21	ASN	422
24	1W21	ASN	427
24	1W21	ASN	449
24	1W21	GLN	233
24	1W21	HIS	150
24	1W21	HIS	240
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26	1W21	ASN	2408
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26	1W21	ASN	2427
26	1W21	ASN	2449
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27	1W21	ASN	3422
27	1W21	ASN	3427
27	1W21	ASN	3449

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27	1W21	HIS	3281
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28	1MVE	ASN	216
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28	1MVE	ASN	294
28	1MVE	ASN	338
28	1MVE	ASN	344
28	1MVE	ASN	346
28	1MVE	ASN	400
28	1MVE	GLN	392
28	1MVE	GLN	395
28	1MVE	HIS	98
28	1MVE	HIS	144
28	1MVE	HIS	233
29	2QWB	ASN	95
29	2QWB	ASN	170
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29	2QWB	GLN	392
29	2QWB	GLN	395
29	2QWB	HIS	98
29	2QWB	HIS	144
29	2QWB	HIS	233
29	2QWB	HIS	274
30	1INY	ASN	95
30	1INY	ASN	171
30	1INY	ASN	200
30	1INY	ASN	201
30	1INY	ASN	217
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31	1INY	ASN	171
31	1INY	ASN	200
31	1INY	ASN	201
31	1INY	ASN	217
31	1INY	ASN	222
31	1INY	ASN	295

31	1IN Y	ASN	330
31	1IN Y	ASN	346
31	1IN Y	ASN	399
31	1IN Y	GLN	394
31	1IN Y	HIS	98
31	1IN Y	HIS	234
32	1F8B	ASN	95
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32	1F8B	ASN	294
32	1F8B	ASN	344
32	1F8B	ASN	346
32	1F8B	ASN	400
32	1F8B	GLN	392
32	1F8B	GLN	395
32	1F8B	HIS	98
32	1F8B	HIS	144
32	1F8B	HIS	233
33	1NNB	ASN	147
33	1NNB	ASN	200
33	1NNB	ASN	345
33	1NNB	ASN	348
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33	1NNB	GLN	137
33	1NNB	GLN	457
33	1NNB	HIS	99
33	1NNB	HIS	314
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34	2QWC	ASN	344
34	2QWC	ASN	346
34	2QWC	ASN	400
34	2QWC	GLN	392
34	2QWC	GLN	395
34	2QWC	HIS	98
34	2QWC	HIS	144
34	2QWC	HIS	233
34	2QWC	HIS	274
35	1F8C	ASN	95
35	1F8C	ASN	170
35	1F8C	ASN	216
35	1F8C	ASN	221
35	1F8C	ASN	294
35	1F8C	ASN	346
35	1F8C	ASN	400
35	1F8C	GLN	392

35	1F8C	GLN	395
35	1F8C	HIS	98
35	1F8C	HIS	144
35	1F8C	HIS	233
36	2QWD	ASN	95
36	2QWD	ASN	170
36	2QWD	ASN	216
36	2QWD	ASN	221
36	2QWD	ASN	344
36	2QWD	ASN	346
36	2QWD	ASN	400
36	2QWD	GLN	392
36	2QWD	GLN	395
36	2QWD	HIS	98
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36	2QWD	HIS	274
37	1F8D	ASN	95
37	1F8D	ASN	170
37	1F8D	ASN	216
37	1F8D	ASN	221
37	1F8D	ASN	294
37	1F8D	ASN	338
37	1F8D	ASN	344
37	1F8D	ASN	346
37	1F8D	ASN	400
37	1F8D	GLN	392
37	1F8D	GLN	395
37	1F8D	HIS	98
37	1F8D	HIS	144
37	1F8D	HIS	233
38	1F8E	ASN	95
38	1F8E	ASN	170
38	1F8E	ASN	216
38	1F8E	ASN	221
38	1F8E	ASN	294
38	1F8E	ASN	344
38	1F8E	ASN	346
38	1F8E	ASN	400
38	1F8E	GLN	392
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38	1F8E	HIS	233
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39	1NNC	ASN	170
39	1NNC	ASN	216
39	1NNC	ASN	221
39	1NNC	ASN	294
39	1NNC	ASN	346

39	1NNC	ASN	400
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39	1NNC	GLN	395
39	1NNC	HIS	98
39	1NNC	HIS	144
39	1NNC	HIS	233
40	2QWE	ASN	95
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40	2QWE	ASN	346
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40	2QWE	GLN	395
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40	2QWE	HIS	144
40	2QWE	HIS	233
40	2QWE	HIS	274
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41	1BJI	ASN	346
41	1BJI	ASN	400
41	1BJI	GLN	392
41	1BJI	GLN	395
41	1BJI	HIS	98
41	1BJI	HIS	144
41	1BJI	HIS	233
41	1BJI	HIS	274
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42	2QWF	ASN	221
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42	2QWF	ASN	400
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42	2QWF	HIS	98
42	2QWF	HIS	144
42	2QWF	HIS	233
43	2QWI	ASN	95
43	2QWI	ASN	170
43	2QWI	ASN	216
43	2QWI	ASN	338
43	2QWI	ASN	346
43	2QWI	ASN	400
43	2QWI	GLN	392
43	2QWI	GLN	395

43	2QWI	HIS	98
43	2QWI	HIS	144
43	2QWI	HIS	233
44	2QWG	ASN	95
44	2QWG	ASN	170
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44	2QWG	ASN	400
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44	2QWG	GLN	395
44	2QWG	HIS	98
44	2QWG	HIS	144
44	2QWG	HIS	233
45	2QWJ	ASN	95
45	2QWJ	ASN	170
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46	2QWH	ASN	216
46	2QWH	ASN	221
46	2QWH	ASN	346
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46	2QWH	HIS	144
46	2QWH	HIS	233
46	2QWH	HIS	274
47	2QWK	ASN	95
47	2QWK	ASN	170
47	2QWK	ASN	216
47	2QWK	ASN	221
47	2QWK	ASN	344
47	2QWK	ASN	346
47	2QWK	ASN	400
47	2QWK	GLN	392
47	2QWK	GLN	395
47	2QWK	HIS	98
47	2QWK	HIS	144
47	2QWK	HIS	233
48	1L7F	ASN	95



48	1L7F	ASN	170
48	1L7F	ASN	216
48	1L7F	ASN	221
48	1L7F	ASN	294
48	1L7F	ASN	338
48	1L7F	ASN	346
48	1L7F	ASN	400
48	1L7F	GLN	392
48	1L7F	GLN	395
48	1L7F	HIS	98
48	1L7F	HIS	233
48	1L7F	HIS	274
49	1L7G	ASN	95
49	1L7G	ASN	170
49	1L7G	ASN	216
49	1L7G	ASN	221
49	1L7G	ASN	294
49	1L7G	ASN	346
49	1L7G	ASN	400
49	1L7G	GLN	392
49	1L7G	GLN	395
49	1L7G	HIS	98
49	1L7G	HIS	233
49	1L7G	HIS	274
50	1L7H	ASN	95
50	1L7H	ASN	170
50	1L7H	ASN	216
50	1L7H	ASN	221
50	1L7H	ASN	338
50	1L7H	ASN	346
50	1L7H	ASN	400
50	1L7H	GLN	392
50	1L7H	GLN	395
50	1L7H	HIS	233
50	1L7H	HIS	274
51	1XOE	ASN	172
51	1XOE	ASN	210
51	1XOE	ASN	331
51	1XOE	ASN	346
51	1XOE	ASN	348
51	1XOE	ASN	443
51	1XOE	GLN	137
51	1XOE	HIS	99
51	1XOE	HIS	314
52	1XOG	ASN	172
52	1XOG	ASN	201
52	1XOG	ASN	210
52	1XOG	ASN	339
52	1XOG	ASN	346
52	1XOG	ASN	348

52	1XOG	ASN	443
52	1XOG	GLN	137
52	1XOG	GLN	457
52	1XOG	HIS	99
52	1XOG	HIS	314
53	1NSC	ASN	168
53	1NSC	ASN	339
53	1NSC	GLN	87
53	1NSC	HIS	133
54	1NSC	ASN	108
54	1NSC	ASN	168
54	1NSC	HIS	133
55	1INV	ASN	144
55	1INV	ASN	169
55	1INV	ASN	340
55	1INV	GLN	93
55	1INV	GLN	453
55	1INV	HIS	134
55	1INV	HIS	215
56	1INV	ASN	144
56	1INV	ASN	169
56	1INV	ASN	340
56	1INV	GLN	93
56	1INV	GLN	453
56	1INV	HIS	134
56	1INV	HIS	215
57	1NSD	ASN	168
57	1NSD	ASN	339
57	1NSD	GLN	87
57	1NSD	HIS	133
58	1NSD	ASN	108
58	1NSD	ASN	168
58	1NSD	HIS	133
59	1A4G	ASN	168
59	1A4G	ASN	229
59	1A4G	ASN	339
59	1A4G	GLN	92
59	1A4G	HIS	133
60	1A4G	ASN	108
60	1A4G	ASN	143
60	1A4G	ASN	168
60	1A4G	ASN	229
60	1A4G	HIS	133
61	1A4Q	ASN	168
61	1A4Q	ASN	339
61	1A4Q	GLN	92
61	1A4Q	HIS	133
62	1A4Q	ASN	108
62	1A4Q	ASN	143
62	1A4Q	ASN	168

62	1A4Q	ASN	229
62	1A4Q	HIS	133
63	1IVB	ASN	169
63	1IVB	ASN	220
63	1IVB	ASN	294
63	1IVB	ASN	340
63	1IVB	GLN	93
63	1IVB	GLN	453
63	1IVB	HIS	134
63	1IVB	HIS	439
64	1INF	ASN	144
64	1INF	ASN	169
64	1INF	ASN	220
64	1INF	ASN	230
64	1INF	ASN	340
64	1INF	GLN	93
64	1INF	HIS	215
65	1B9S	ASN	169
65	1B9S	ASN	284
65	1B9S	ASN	340
65	1B9S	GLN	93
65	1B9S	HIS	134
66	1VCJ	ASN	144
66	1VCJ	ASN	169
66	1VCJ	ASN	340
66	1VCJ	GLN	88
66	1VCJ	GLN	93
66	1VCJ	HIS	134
67	1VCJ	ASN	144
67	1VCJ	ASN	169
67	1VCJ	ASN	340
67	1VCJ	GLN	88
67	1VCJ	GLN	93
67	1VCJ	HIS	134
68	1B9V	ASN	144
68	1B9V	ASN	169
68	1B9V	ASN	230
68	1B9V	ASN	340
68	1B9V	ASN	373
68	1B9V	GLN	93
69	1B9V	ASN	144
69	1B9V	ASN	169
69	1B9V	ASN	230
69	1B9V	ASN	340
69	1B9V	ASN	373
69	1B9V	GLN	93
70	1B9T	ASN	144
70	1B9T	ASN	169
70	1B9T	ASN	198
70	1B9T	ASN	230

70	1B9T	ASN	340
70	1B9T	GLN	88
70	1B9T	GLN	93
70	1B9T	HIS	134

Protonation sites for histidine residues  
PDB

No.	Code	list of hydrogens attached to side-chain nitrogens, first, hydrogen name then after underscore, r							
1	2BAT	HD1_144	HD1_150	HE2_155	HD1_168	HE2_184	HE2_191	HE2_264	HE2_274
2	1INW	HD1_144	HE2_144	HE2_150	HE2_155	HD1_168	HE2_184	HE2_191	HE2_264
3	1INW	HD1_144	HE2_144	HE2_150	HE2_155	HD1_168	HE2_184	HE2_191	HE2_264
4	1INX	HD1_144	HE2_150	HE2_155	HD1_168	HE2_184	HE2_191	HE2_264	HE2_274
5	1INX	HD1_144	HE2_150	HE2_155	HD1_168	HE2_184	HE2_191	HE2_264	HE2_274
6	1IVF	HE2_144	HE2_150	HE2_155	HD1_168	HE2_184	HE2_191	HE2_264	HE2_274
7	1IVD	HE2_144	HD1_150	HE2_155	HD1_168	HE2_184	HD1_191	HE2_264	HE2_274
8	1IVC	HE2_144	HE2_150	HE2_155	HE2_168	HE2_184	HE2_191	HE2_264	HE2_274
9	1IVC	HE2_144	HE2_150	HE2_155	HE2_168	HE2_184	HE2_191	HE2_264	HE2_274
10	1IVE	HE2_144	HE2_150	HE2_155	HD1_168	HE2_184	HE2_191	HE2_264	HE2_274
11	1IVE	HE2_144	HE2_150	HE2_155	HD1_168	HE2_184	HE2_191	HE2_264	HE2_274
12	1ING	HE2_144	HE2_150	HE2_155	HE2_168	HE2_184	HE2_191	HE2_264	HE2_274
13	1ING	HE2_144	HE2_150	HE2_155	HE2_168	HE2_184	HE2_191	HE2_264	HE2_274
14	1INH	HE2_144	HE2_150	HE2_155	HE2_168	HE2_184	HE2_191	HE2_264	HE2_274
15	1INH	HE2_144	HE2_150	HE2_155	HE2_168	HE2_184	HE2_191	HE2_264	HE2_274
16	1W1X	HD1_104	HE2_119	HD1_150	HE2_156	HE2_191	HE2_240	HE2_281	HD1_319
17	1W1X	HD1_104	HE2_104	HD1_119	HD1_150	HD1_156	HE2_191	HE2_240	HE2_281
18	1W1X	HD1_104	HE2_104	HD1_119	HD1_150	HE2_156	HE2_191	HE2_240	HE2_281
19	1W1X	HD1_104	HE2_119	HD1_150	HD1_156	HE2_191	HE2_240	HE2_281	HD1_319
20	1W20	HD1_104	HE2_119	HD1_150	HD1_156	HE2_191	HE2_240	HE2_281	HD1_319
21	1W20	HD1_104	HE2_119	HD1_150	HD1_156	HE2_191	HE2_240	HE2_281	HD1_319
22	1W20	HD1_104	HE2_119	HD1_150	HE2_156	HE2_191	HE2_240	HE2_281	HD1_319
23	1W20	HD1_104	HE2_119	HD1_150	HD1_156	HE2_191	HE2_240	HE2_281	HD1_319
24	1W21	HD1_104	HE2_119	HD1_150	HD1_156	HE2_191	HE2_240	HE2_281	HD1_319
25	1W21	HD1_104	HE2_119	HD1_150	HD1_156	HE2_191	HE2_240	HE2_281	HD1_319
26	1W21	HD1_104	HE2_119	HD1_150	HE2_156	HE2_191	HE2_240	HE2_281	HD1_319
27	1W21	HD1_104	HE2_119	HD1_150	HD1_156	HE2_191	HE2_240	HE2_281	HD1_319
28	1MVE	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
29	2QWB	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
30	1INY	HD1_98	HE2_144	HE2_150	HE2_185	HE2_234	HE2_275	HD1_313	
31	1INY	HD1_98	HE2_144	HE2_150	HE2_185	HE2_234	HE2_275	HD1_313	
32	1F8B	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
33	1NNB	HD1_99	HE2_145	HE2_151	HE2_186	HE2_235	HD1_276	HD1_314	
34	2QWC	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
35	1F8C	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
37	1F8D	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
37	2QWD	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
38	1F8E	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
39	1NNC	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
40	2QWE	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
41	1BJI	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HD1_274	HE2_274	HD1_312

42	2QWF	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HD1_274	HE2_274	HD1_312
43	2QWI	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HD1_274	HE2_274	HD1_312
44	2QWG	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HD1_274	HE2_274	HD1_312
45	2QWJ	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
46	2QWH	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HE2_274	HD1_312	
47	2QWK	HD1_98	HD1_144	HE2_150	HE2_184	HE2_233	HD1_274	HE2_274	HD1_312
48	1L7F	HD1_98	HE2_144	HE2_150	HE2_184	HE2_233	HD1_274	HE2_274	HD1_312
49	1L7G	HD1_98	HE2_144	HE2_150	HE2_184	HE2_233	HD1_274	HE2_274	HD1_312
50	1L7H	HD1_98	HE2_144	HE2_150	HE2_184	HE2_233	HD1_274	HE2_274	HD1_312
51	1XOE	HD1_99	HE2_145	HE2_151	HE2_186	HE2_235	HD1_276	HD1_314	
52	1XOG	HD1_99	HE2_145	HD1_151	HE2_186	HE2_235	HE2_276	HD1_314	
53	1NSC	HD1_100	HD1_128	HE2_133	HD1_154	HE2_172	HE2_182	HE2_214	HD1_272
54	1NSC	HD1_100	HD1_128	HE2_133	HD1_154	HE2_172	HE2_182	HE2_214	HD1_272
55	1INV	HD1_101	HD1_129	HE2_134	HD1_155	HE2_173	HE2_183	HE2_215	HD1_219
56	1INV	HD1_101	HD1_129	HE2_134	HD1_155	HE2_173	HE2_183	HE2_215	HD1_219
57	1NSD	HD1_100	HD1_128	HE2_133	HD1_154	HE2_172	HE2_182	HE2_214	HD1_272
58	1NSD	HD1_100	HD1_128	HE2_133	HD1_154	HD1_172	HE2_182	HE2_214	HD1_272
59	1A4G	HD1_100	HD1_128	HE2_133	HD1_154	HE2_172	HE2_182	HE2_214	HD1_272
60	1A4G	HD1_100	HD1_128	HE2_133	HD1_154	HE2_172	HE2_182	HE2_214	HD1_272
61	1A4Q	HD1_100	HD1_128	HE2_133	HD1_154	HE2_172	HE2_182	HE2_214	HD1_272
62	1A4Q	HD1_100	HD1_128	HE2_133	HD1_154	HE2_172	HE2_182	HE2_214	HD1_272
63	1IVB	HD1_101	HD1_129	HE2_134	HD1_155	HD1_173	HE2_183	HE2_215	HD1_219
64	1INF	HD1_101	HD1_129	HE2_134	HD1_155	HD1_173	HE2_183	HD1_215	HD1_219
65	1B9S	HD1_101	HD1_129	HE2_134	HD1_155	HD1_173	HE2_183	HE2_215	HD1_219
66	1VCJ	HD1_101	HD1_129	HE2_134	HD1_155	HD1_173	HE2_183	HD1_215	HE2_219
67	1VCJ	HD1_101	HD1_129	HE2_134	HD1_155	HD1_173	HE2_183	HD1_215	HE2_219
68	1B9V	HD1_101	HD1_129	HE2_134	HD1_155	HD1_173	HE2_183	HD1_215	HE2_219
69	1B9V	HD1_101	HD1_129	HE2_134	HD1_155	HD1_173	HE2_183	HD1_215	HE2_219
70	1B9T	HD1_101	HD1_129	HE2_134	HD1_155	HE2_173	HE2_183	HD1_215	HD1_219

## Tables S4-S5

### Whole inhibitor

NA strain	structure		inh inhibitor	inh charge	ARG 118	ASP 151	ARG 152	ARG 224
N2	2BAT	Asp339Asn	SIA	-1	-257	269	-218	-144
N2	1INW	wt	AXP	-2	-507	439	-397	-291
N2	1INW	wt	AXP-H	-1	-284	217	-243	-152
N2	1INX	wt	EQP	-2	-522	459	-415	-282
N2	1INX	wt	EQP-H	-1	-294	224	-256	-142
N2	1IVF	wt	DAN	-1	-238	236	-255	-180
N2	1IVD	wt	ST1	-1	-258	237	-220	-179
N2	1IVC	wt	ST2	-1	-281	246	-252	-125
N2	1IVC	wt	ST2-H	0	-94	-3	-20	70
N2	1IVE	wt	ST3	-1	-231	261	-213	-136
N2	1IVE	wt	ST3-H	0	-55	-11	21	53
N2	1ING A	wt	ST5	-1	-216	236	-186	-138
N2	1ING B	wt	ST5	-1	-216	237	-186	-137
N2	1ING averaged	wt	ST5	-1	-216	237	-186	-137
N2	1INH A	wt	ST6	0	-134	90	-12	116
N2	1INH B	wt	ST6	0	-134	90	-12	116
N2	1INH averaged	wt	ST6	0	-134	90	-12	116
N6	1W1X A	wt	SIA	-1	-252	281	-246	-127
N6	1W1X B	wt	SIA	-1	-230	198	-268	-146
N6	1W1X C	wt	SIA	-1	-281	289	-248	-141
N6	1W1X D	wt	SIA	-1	-292	287	-235	-127
N6	1W20 IA	wt	SIA	-1	-278	291	-236	-120
N6	1W20 B	wt	SIA	-1	-273	284	-250	-127
N6	1W20 C	wt	SIA	-1	-290	288	-239	-123
N6	1W20 D	wt	SIA	-1	-275	289	-242	-134
N6	1W21 A	wt	SIA	-1	-278	291	-236	-120
N6	1W21 B	wt	SIA	-1	-273	284	-250	-127
N6	1W21 C	wt	SIA	-1	-290	288	-239	-123
N6	1W21 D	wt	SIA	-1	-275	289	-242	-134
N6	N6:SIA averaged	wt	SIA	-1	-274	280	-244	-129
N9	1MVE	wt	SIA	-1	-310	234	-243	-128
N9	2QWB	Arg292Lys	SIA	-1	-280	242	-229	-126
N9	1INY	Ser370Lys	EQP	-2	-490	373	-373	-279
N9	1INY	Ser370Lys	EQP-H	-1	-246	147	-222	-148
N9	1F8B	wt	DAN	-1	-331	256	-243	-128
N9	1NNB	wt	DAN	-1	-302	258	-243	-116
N9	N9:DAN averaged	wt	DAN	-1	-317	257	-243	-122
N9	2QWC	Arg292Lys	DAN	-1	-301	250	-263	-134
N9	1F8C	wt	4AM	0	-103	-166	-30	30
N9	2QWD	Arg292Lys	4AM	0	-95	-141	-10	55
N9	1F8D	wt	9AM	0	-159	68	-57	113
N9	1F8E	wt	49A	1	39	-284	150	285
N9	1NNC	wt	GNA	0	-125	-76	-18	42

N9	2QWE	Arg292Lys	GNA	0	-129	-84	-38	57
N9	1BJI	wt	G21	0	-109	-89	-20	57
N9	2QWF	Arg292Lys	G20	0	-149	-61	-24	81
N9	2QWI	wt	G20	0	-150	-50	-15	72
N9	2QWG	Arg292Lys	G28	0	-134	-114	-36	65
N9	2QWJ	wt	G28	0	-126	-99	-43	66
N9	2QWH	Arg292Lys	G39	0	-115	-95	-37	53
N9	2QWK	wt	G39	0	-109	-160	-31	62
N9	1L7F	wt	BCZ	0	-151	-113	-37	52
N9	1L7G	Glu119Gly	BCZ	0	-138	-116	-37	52
N9	1L7H	Arg292Lys	BCZ	0	-141	-114	-34	54
N9	1XOE	wt	ABX	0	-104	-29	-49	64
N9	1XOG	wt	ABW	-1	-278	213	-219	-131
B	1NSC A	wt	SIA	-1	-266	192	-255	-140
B	1NSC B	wt	SIA	-1	-246	181	-264	-147
B	1NSC averaged	wt	SIA	-1	-256	187	-260	-144
B	1INV	wt	EQP	-2	-572	457	-371	-263
B	1INV	wt	EQP-H	-1	-328	227	-219	-125
B	1NSD A	wt	DAN	-1	-297	244	-266	-141
B	1NSD B	wt	DAN	-1	-272	242	-257	-145
B	1NSD averaged	wt	DAN	-1	-284	243	-261	-143
B	1A4G A	wt	ZMR	0	-135	-44	-50	56
B	1A4G B	wt	ZMR	0	-126	-30	-28	52
B	1A4G averaged	wt	ZMR	0	-131	-37	-39	54
B	1A4Q A	wt	DPC	0	-115	-64	-49	61
B	1A4Q B	wt	DPC	0	-109	-49	-42	61
B	1A4Q averaged	wt	DPC	0	-112	-57	-45	61
B	1IVB	wt	ST1	-1	-300	255	-242	-165
B	1INF	Arg382Lys	ST4	0	-114	43	-3	89
B	1B9S	wt	FDI	-1	-270	257	-195	-134
B	1VCJ	wt	IBA	0	-166	98	-37	146
B	1VCJ	wt	IBA-H	1	-6	-125	188	371
B	1B9V	wt	RA2	-1	-300	274	-228	-138
B	1B9V	wt	RA2-H	0	-140	64	-21	94
B	1B9T	wt	RAI	0	-160	55	-6	77

## C2-group

NA strain	structure		inhibitor	inh charge	ARG 118	ASP 151	ARG 152	ARG 22.
N2	2BAT	Asp339Asn	SIA	-1	-224	191	-97	-8
N2	1INW	wt	AXP	-2	-441	334	-209	-18
N2	1INW	wt	AXP-H	-1	-245	148	-90	-8
N2	1INX	wt	EQP	-2	-450	353	-218	-18
N2	1INX	wt	EQP-H	-1	-249	155	-94	-8
N2	1IVF	wt	DAN	-1	-136	87	-51	-4
N2	1IVD	wt	ST1	-1	-215	169	-98	-9
N2	1IVC	wt	ST2	-1	-234	194	-114	-9
N2	1IVC	wt	ST2-H	0	-204	164	-97	-8
N2	1IVE	wt	ST3	-1	-195	196	-114	-9

N2	1IVE	wt	ST3-H	0	-169	167	-97	-8
N2	1ING A	wt	ST5	-1	-180	155	-98	-9
N2	1ING B	wt	ST5	-1	-180	155	-98	-9
N2	1ING averaged	wt	ST5	-1	-180	155	-98	-9
N2	1INH A	wt	ST6	0	-216	171	-92	-8
N2	1INH B	wt	ST6	0	-216	171	-92	-8
N2	1INH averaged	wt	ST6	0	-216	171	-92	-8
N6	1W1X A	wt	SIA	-1	-213	186	-105	-9
N6	1W1X B	wt	SIA	-1	-202	128	-102	-9
N6	1W1X C	wt	SIA	-1	-245	204	-108	-8
N6	1W1X D	wt	SIA	-1	-252	193	-106	-8
N6	1W20 IA	wt	SIA	-1	-239	202	-106	-8
N6	1W20 B	wt	SIA	-1	-235	195	-108	-8
N6	1W20 C	wt	SIA	-1	-251	200	-107	-8
N6	1W20 D	wt	SIA	-1	-238	202	-108	-8
N6	1W21 A	wt	SIA	-1	-239	202	-106	-8
N6	1W21 B	wt	SIA	-1	-235	195	-108	-8
N6	1W21 C	wt	SIA	-1	-251	200	-107	-8
N6	1W21 D	wt	SIA	-1	-238	202	-108	-8
N6	N6:SIA averaged	wt	SIA	-1	-236	192	-106	-8
N9	1MVE	wt	SIA	-1	-263	145	-93	-8
N9	2QWB	Arg292Lys	SIA	-1	-231	151	-103	-9
N9	1INY	Ser370Lys	EQP	-2	-431	331	-206	-17
N9	1INY	Ser370Lys	EQP-H	-1	-213	141	-90	-8
N9	1F8B	wt	DAN	-1	-205	78	-49	-4
N9	1NNB	wt	DAN	-1	-173	73	-48	-4
N9	N9:DAN averaged	wt	DAN	-1	-189	76	-49	-4
N9	2QWC	Arg292Lys	DAN	-1	-194	78	-49	-4
N9	1F8C	wt	4AM	0	-187	68	-44	-4
N9	2QWD	Arg292Lys	4AM	0	-175	65	-43	-4
N9	1F8D	wt	9AM	0	-173	70	-44	-4
N9	1F8E	wt	49A	1	-167	59	-39	-3
N9	1NNC	wt	GNA	0	-177	66	-41	-3
N9	2QWE	Arg292Lys	GNA	0	-180	65	-41	-3
N9	1BJI	wt	G21	0	-172	69	-47	-4
N9	2QWF	Arg292Lys	G20	0	-185	69	-44	-4
N9	2QWI	wt	G20	0	-186	65	-42	-4
N9	2QWG	Arg292Lys	G28	0	-204	68	-46	-4
N9	2QWJ	wt	G28	0	-194	68	-46	-4
N9	2QWH	Arg292Lys	G39	0	-253	145	-93	-8
N9	2QWK	wt	G39	0	-249	144	-94	-8
N9	1L7F	wt	BCZ	0	-251	103	-74	-7
N9	1L7G	Glu119Gly	BCZ	0	-237	102	-73	-7
N9	1L7H	Arg292Lys	BCZ	0	-239	102	-73	-7
N9	1XOE	wt	ABX	0	-183	84	-60	-6
N9	1XOG	wt	ABW	-1	-209	127	-85	-8
B	1NSC A	wt	SIA	-1	-225	118	-94	-9
B	1NSC B	wt	SIA	-1	-222	116	-93	-9
B	1NSC averaged	wt	SIA	-1	-224	117	-94	-9



B	1INV	wt	EQP	-2	-501	340	-207	-18
B	1INV	wt	EQP-H	-1	-285	146	-90	-8
B	1NSD A	wt	DAN	-1	-177	75	-48	-4
B	1NSD B	wt	DAN	-1	-163	75	-47	-4
B	1NSD averaged	wt	DAN	-1	-170	75	-47	-4
B	1A4G A	wt	ZMR	0	-187	65	-42	-3
B	1A4G B	wt	ZMR	0	-176	63	-41	-3
B	1A4G averaged	wt	ZMR	0	-181	64	-42	-3
B	1A4Q A	wt	DPC	0	-184	70	-47	-4
B	1A4Q B	wt	DPC	0	-180	70	-47	-4
B	1A4Q averaged	wt	DPC	0	-182	70	-47	-4
B	1IVB	wt	ST1	-1	-263	160	-97	-9
B	1INF	Arg382Lys	ST4	0	-213	153	-89	-8
B	1B9S	wt	FDI	-1	-225	166	-105	-10
B	1VCJ	wt	IBA	0	-241	155	-103	-9
B	1VCJ	wt	IBA-H	1	-228	143	-95	-8
B	1B9V	wt	RA2	-1	-244	163	-104	-9
B	1B9V	wt	RA2-H	0	-230	151	-96	-9
B	1B9T	wt	RAI	0	-254	140	-89	-8

## Tables S6-S7

### C3-group

NA strain	structure		inh inhibitor	inh charge	ARG 118	ASP 151	ARG 152	ARG 224
N2	2BAT	Asp339Asn	SIA	-1	32	-36	11	8
N2	1INW	wt	AXP	-2	23	-25	8	5
N2	1INW	wt	AXP-H	-1	28	-31	11	8
N2	1INX	wt	EQP	-2	19	-37	11	6
N2	1INX	wt	EQP-H	-1	24	-43	14	8
N2	1IVF	wt	DAN	-1	-47	56	-37	-32
N2	1IVD	wt	ST1	-1	32	-35	7	5
N2	1IVC	wt	ST2	-1	10	1	-1	1
N2	1IVC	wt	ST2-H	0	23	-13	9	10
N2	1IVE	wt	ST3	-1	14	-4	-2	-1
N2	1IVE	wt	ST3-H	0	30	-21	7	6
N2	1ING A	wt	ST5	-1	27	-12	5	4
N2	1ING B	wt	ST5	-1	27	-12	5	4
N2	1ING averaged	wt	ST5	-1	27	-12	5	4
N2	1INH A	wt	ST6	0	30	-27	9	6
N2	1INH B	wt	ST6	0	30	-27	9	6
N2	1INH averaged	wt	ST6	0	30	-27	9	6
N6	1W1X A	wt	SIA	-1	31	-32	12	8
N6	1W1X B	wt	SIA	-1	30	-30	12	8
N6	1W1X C	wt	SIA	-1	31	-32	12	8
N6	1W1X D	wt	SIA	-1	31	-28	11	8
N6	1W20 IA	wt	SIA	-1	31	-31	11	8
N6	1W20 B	wt	SIA	-1	30	-29	11	9
N6	1W20 C	wt	SIA	-1	30	-30	11	9
N6	1W20 D	wt	SIA	-1	30	-30	11	9
N6	1W21 A	wt	SIA	-1	31	-31	11	8
N6	1W21 B	wt	SIA	-1	30	-29	11	9
N6	1W21 C	wt	SIA	-1	30	-30	11	9
N6	1W21 D	wt	SIA	-1	30	-30	11	9
N6	N6:SIA averaged	wt	SIA	-1	31	-30	11	8
N9	1MVE	wt	SIA	-1	31	-31	12	8
N9	2QWB	Arg292Lys	SIA	-1	31	-38	12	8
N9	1INY	Ser370Lys	EQP	-2	18	-33	11	6
N9	1INY	Ser370Lys	EQP-H	-1	22	-39	14	8
N9	1F8B	wt	DAN	-1	-45	53	-37	-32
N9	1NNB	wt	DAN	-1	-46	51	-38	-32
N9	N9:DAN averaged	wt	DAN	-1	-46	52	-37	-32
N9	2QWC	Arg292Lys	DAN	-1	-45	56	-37	-32
N9	1F8C	wt	4AM	0	-41	48	-34	-30
N9	2QWD	Arg292Lys	4AM	0	-40	52	-34	-30
N9	1F8D	wt	9AM	0	-41	49	-34	-29
N9	1F8E	wt	49A	1	-37	45	-32	-28
N9	1NNC	wt	GNA	0	-38	47	-32	-29

N9	2QWE	Arg292Lys	GNA	0	-38	49	-33	-29
N9	1BJI	wt	G21	0	-49	54	-35	-31
N9	2QWF	Arg292Lys	G20	0	-39	44	-34	-29
N9	2QWI	wt	G20	0	-40	48	-34	-30
N9	2QWG	Arg292Lys	G28	0	-46	57	-36	-30
N9	2QWJ	wt	G28	0	-47	54	-36	-30
N9	2QWH	Arg292Lys	G39	0	44	-53	21	16
N9	2QWK	wt	G39	0	43	-52	21	16
N9	1L7F	wt	BCZ	0	21	-20	7	6
N9	1L7G	Glu119Gly	BCZ	0	21	-19	7	6
N9	1L7H	Arg292Lys	BCZ	0	21	-16	6	6
N9	1XOE	wt	ABX	0	27	-27	10	8
N9	1XOG	wt	ABW	-1	19	-22	6	4
B	1NSC A	wt	SIA	-1	30	-31	12	9
B	1NSC B	wt	SIA	-1	31	-34	12	9
B	1NSC averaged	wt	SIA	-1	31	-32	12	9
B	1INV	wt	EQP	-2	20	-26	9	6
B	1INV	wt	EQP-H	-1	25	-32	12	8
B	1NSD A	wt	DAN	-1	-47	54	-37	-33
B	1NSD B	wt	DAN	-1	-49	55	-36	-33
B	1NSD averaged	wt	DAN	-1	-48	54	-37	-33
B	1A4G A	wt	ZMR	0	-38	52	-33	-30
B	1A4G B	wt	ZMR	0	-38	50	-34	-30
B	1A4G averaged	wt	ZMR	0	-38	51	-34	-30
B	1A4Q A	wt	DPC	0	-47	59	-36	-31
B	1A4Q B	wt	DPC	0	-47	59	-36	-32
B	1A4Q averaged	wt	DPC	0	-47	59	-36	-32
B	1IVB	wt	ST1	-1	27	-24	7	5
B	1INF	Arg382Lys	ST4	0	30	-31	9	7
B	1B9S	wt	FDI	-1	15	-7	0	-1
B	1VCJ	wt	IBA	0	14	-10	2	1
B	1VCJ	wt	IBA-H	1	21	-18	6	5
B	1B9V	wt	RA2	-1	14	-11	0	-1
B	1B9V	wt	RA2-H	0	22	-19	5	3
B	1B9T	wt	RAI	0	30	-25	9	7

## C4-group

NA strain	structure		inh inhibitor	inh charge	ARG 118	ASP 151	ARG 152	ARG 224
N2	2BAT	Asp339Asn	SIA	-1	-2	18	-20	-1
N2	1INW	wt	AXP	-2	-8	15	-27	-1
N2	1INW	wt	AXP-H	-1	-4	10	-23	-1
N2	1INX	wt	EQP	-2	-17	27	-23	-
N2	1INX	wt	EQP-H	-1	-13	22	-19	-
N2	1IVF	wt	DAN	-1	-4	12	-23	-1
N2	1IVD	wt	ST1	-1	-27	37	-19	-1
N2	1IVC	wt	ST2	-1	-3	9	-1	1
N2	1IVC	wt	ST2-H	0	118	-141	136	14
N2	1IVE	wt	ST3	-1	15	-30	20	1

N2	1IVE	wt	ST3-H	0	-2	1	-14	-1
N2	1ING A	wt	ST5	-1	12	-13	9	
N2	1ING B	wt	ST5	-1	12	-13	9	
N2	1ING averaged	wt	ST5	-1	12	-13	9	
N2	1INH A	wt	ST6	0	13	-22	13	
N2	1INH B	wt	ST6	0	13	-22	13	
N2	1INH averaged	wt	ST6	0	13	-22	13	
N6	1W1X A	wt	SIA	-1	-2	27	-21	-1
N6	1W1X B	wt	SIA	-1	-2	24	-22	-1
N6	1W1X C	wt	SIA	-1	-2	21	-22	-1
N6	1W1X D	wt	SIA	-1	-2	23	-21	-1
N6	1W20 IA	wt	SIA	-1	-2	25	-21	-1
N6	1W20 B	wt	SIA	-1	-2	22	-22	-1
N6	1W20 C	wt	SIA	-1	-2	21	-22	-1
N6	1W20 D	wt	SIA	-1	-2	22	-22	-1
N6	1W21 A	wt	SIA	-1	-2	25	-21	-1
N6	1W21 B	wt	SIA	-1	-2	22	-22	-1
N6	1W21 C	wt	SIA	-1	-2	21	-22	-1
N6	1W21 D	wt	SIA	-1	-2	22	-22	-1
N6	N6:SIA averaged	wt	SIA	-1	-2	23	-22	-1
N9	1MVE	wt	SIA	-1	-16	32	-15	-
N9	2QWB	Arg292Lys	SIA	-1	-17	33	-15	-
N9	1INY	Ser370Lys	EQP	-2	-10	-26	-17	-1
N9	1INY	Ser370Lys	EQP-H	-1	-6	-32	-13	-1
N9	1F8B	wt	DAN	-1	-20	28	-18	-
N9	1NNB	wt	DAN	-1	-19	34	-18	-
N9	N9:DAN averaged	wt	DAN	-1	-19	31	-18	-
N9	2QWC	Arg292Lys	DAN	-1	-6	24	-25	-1
N9	1F8C	wt	4AM	0	145	-318	149	10
N9	2QWD	Arg292Lys	4AM	0	150	-310	145	10
N9	1F8D	wt	9AM	0	1	17	-19	-
N9	1F8E	wt	49A	1	154	-275	157	10
N9	1NNC	wt	GNA	0	101	-215	117	9
N9	2QWE	Arg292Lys	GNA	0	102	-221	123	9
N9	1BJI	wt	G21	0	136	-273	124	8
N9	2QWF	Arg292Lys	G20	0	91	-216	116	8
N9	2QWI	wt	G20	0	90	-204	110	8
N9	2QWG	Arg292Lys	G28	0	141	-297	138	9
N9	2QWJ	wt	G28	0	140	-278	139	9
N9	2QWH	Arg292Lys	G39	0	132	-244	127	9
N9	2QWK	wt	G39	0	132	-307	131	8
N9	1L7F	wt	BCZ	0	63	-164	83	5
N9	1L7G	Glu119Gly	BCZ	0	62	-166	84	5
N9	1L7H	Arg292Lys	BCZ	0	63	-160	83	5
N9	1XOE	wt	ABX	0	-43	30	-35	-3
N9	1XOG	wt	ABW	-1	-61	53	-54	-4
B	1NSC A	wt	SIA	-1	-19	30	-12	-
B	1NSC B	wt	SIA	-1	-3	24	-21	-1
B	1NSC averaged	wt	SIA	-1	-11	27	-17	-

B	1INV	wt	EQP	-2	-21	37	-18	-
B	1INV	wt	EQP-H	-1	-17	32	-14	-
B	1NSD A	wt	DAN	-1	-22	35	-17	-
B	1NSD B	wt	DAN	-1	-7	31	-25	-1
B	1NSD averaged	wt	DAN	-1	-14	33	-21	-
B	1A4G A	wt	ZMR	0	106	-197	121	9
B	1A4G B	wt	ZMR	0	105	-179	122	8
B	1A4G averaged	wt	ZMR	0	106	-188	122	9
B	1A4Q A	wt	DPC	0	140	-252	126	8
B	1A4Q B	wt	DPC	0	140	-236	127	8
B	1A4Q averaged	wt	DPC	0	140	-244	126	8
B	1IVB	wt	ST1	-1	-8	20	-24	-1
B	1INF	Arg382Lys	ST4	0	16	-26	14	1
B	1B9S	wt	FDI	-1	4	-9	4	
B	1VCJ	wt	IBA	0	7	-11	5	
B	1VCJ	wt	IBA-H	1	13	-19	10	
B	1B9V	wt	RA2	-1	4	-11	4	
B	1B9V	wt	RA2-H	0	10	-19	10	
B	1B9T	wt	RAI	0	16	-23	14	1

## Tables S8-S9

### C5-group

NA strain	structure		inhibitor	inh charge	ARG 118	ASP 151	ARG 152	ARG 224
N2	2BAT	Asp339Asn	SIA	-1	-14	24	-71	-15
N2	1INW	wt	AXP	-2	-11	25	-100	-14
N2	1INW	wt	AXP-H	-1	-3	13	-86	-1
N2	1INX	wt	EQP	-2	-13	29	-99	-8
N2	1INX	wt	EQP-H	-1	-5	17	-85	5
N2	1IVF	wt	DAN	-1	-5	13	-72	-1
N2	1IVD	wt	ST1	-1	-20	30	-69	-24
N2	1IVC	wt	ST2	-1	-54	91	-119	-35
N2	1IVC	wt	ST2-H	0	-16	30	-40	24
N2	1IVE	wt	ST3	-1	-54	81	-123	-67
N2	1IVE	wt	ST3-H	0	-13	3	-50	-17
N2	1ING A	wt	ST5	-1	-32	63	-76	-15
N2	1ING B	wt	ST5	-1	-32	63	-76	-15
	1ING							
N2	averaged	wt	ST5	-1	-32	63	-76	-15
N2	1INH A	wt	ST6	0	-19	44	-31	10
N2	1INH B	wt	ST6	0	-19	44	-31	10
	1INH							
N2	averaged	wt	ST6	0	-19	44	-31	10
N6	1W1X A	wt	SIA	-1	-15	29	-86	-13
N6	1W1X B	wt	SIA	-1	-14	27	-100	-15
N6	1W1X C	wt	SIA	-1	-15	27	-89	-12
N6	1W1X D	wt	SIA	-1	-15	28	-76	-13
N6	1W20 IA	wt	SIA	-1	-15	24	-83	-13
N6	1W20 B	wt	SIA	-1	-15	27	-91	-13
N6	1W20 C	wt	SIA	-1	-15	26	-81	-12
N6	1W20 D	wt	SIA	-1	-15	25	-84	-14
N6	1W21 A	wt	SIA	-1	-15	24	-83	-13
N6	1W21 B	wt	SIA	-1	-15	27	-91	-13
N6	1W21 C	wt	SIA	-1	-15	26	-81	-12
N6	1W21 D	wt	SIA	-1	-15	25	-84	-14
	N6:SIA							
N6	averaged	wt	SIA	-1	-15	26	-86	-13
N9	1MVE	wt	SIA	-1	-14	21	-106	-15
N9	2QWB	Arg292Lys	SIA	-1	-14	25	-80	-13
N9	1INY	Ser370Lys	EQP	-2	-10	24	-78	-12
N9	1INY	Ser370Lys	EQP-H	-1	-3	13	-64	0
N9	1F8B	wt	DAN	-1	-5	17	-80	4
N9	1NNB	wt	DAN	-1	-6	9	-75	11
	N9:DAN							
N9	averaged	wt	DAN	-1	-6	13	-77	8
N9	2QWC	Arg292Lys	DAN	-1	-4	13	-82	3
N9	1F8C	wt	4AM	0	8	-3	-58	28
N9	2QWD	Arg292Lys	4AM	0	7	-5	-49	30
N9	1F8D	wt	9AM	0	8	-6	-56	24
N9	1F8E	wt	49A	1	19	-22	-42	45

N9	1NNC	wt	GNA	0	11	-9	-24	39
N9	2QWE	Arg292Lys	GNA	0	11	-14	-50	40
N9	1BJI	wt	G21	0	-8	19	-61	1
N9	2QWF	Arg292Lys	G20	0	4	3	-55	30
N9	2QWI	wt	G20	0	5	1	-37	28
N9	2QWG	Arg292Lys	G28	0	-1	6	-71	13
N9	2QWJ	wt	G28	0	-2	8	-78	12
N9	2QWH	Arg292Lys	G39	0	-10	22	-90	3
N9	2QWK	wt	G39	0	-10	24	-92	2
N9	1L7F	wt	BCZ	0	-20	50	-110	-16
N9	1L7G	Glu119Gly	BCZ	0	-20	50	-112	-16
N9	1L7H	Arg292Lys	BCZ	0	-20	50	-110	-15
N9	1XOE	wt	ABX	0	3	13	-88	8
N9	1XOG	wt	ABW	-1	-17	41	-88	-30
B	1NSC A	wt	SIA	-1	-14	22	-107	-15
B	1NSC B	wt	SIA	-1	-14	22	-108	-15
B	1NSC							
B	averaged	wt	SIA	-1	-14	22	-108	-15
B	1INV	wt	EQP	-2	-11	25	-80	-13
B	1INV	wt	EQP-H	-1	-3	14	-66	0
B	1NSD A	wt	DAN	-1	-4	12	-95	1
B	1NSD B	wt	DAN	-1	-4	12	-82	2
B	1NSD							
B	averaged	wt	DAN	-1	-4	12	-88	2
B	1A4G A	wt	ZMR	0	13	-18	-66	38
B	1A4G B	wt	ZMR	0	13	-13	-48	37
B	1A4G							
B	averaged	wt	ZMR	0	13	-15	-57	38
B	1A4Q A	wt	DPC	0	-7	15	-89	0
B	1A4Q B	wt	DPC	0	-6	14	-83	-1
B	1A4Q							
B	averaged	wt	DPC	0	-7	14	-86	0
B	1IVB	wt	ST1	-1	-27	60	-88	-7
B	1INF	Arg382Lys	ST4	0	-12	30	-32	10
B	1B9S	wt	FDI	-1	-24	47	-39	-12
B	1VCJ	wt	IBA	0	11	28	-34	120
B	1VCJ	wt	IBA-H	1	52	-32	31	182
B	1B9V	wt	RA2	-1	-100	163	-180	-125
B	1B9V	wt	RA2-H	0	-61	108	-119	-68
B	1B9T	wt	RAI	0	-17	44	-37	8

## C6-group

NA strain	structure		inhibitor	inh charge	ARG 118	ASP 151	ARG 152	ARG 224
N2	2BAT	Asp339Asn	SIA	-1	1	13	-1	
N2	1INW	wt	AXP	-2	-21	33	-25	-4
N2	1INW	wt	AXP-H	-1	-11	20	-12	-2
N2	1INX	wt	EQP	-2	-13	22	-38	-4
N2	1INX	wt	EQP-H	-1	-2	9	-25	-2
N2	1IVF	wt	DAN	-1	0	5	-30	-5

N2	1IVD	wt	ST1	-1	-33	45	-49	-6
N2	1IVC	wt	ST2	-1	-3	-32	-19	-
N2	1IVC	wt	ST2-H	0	-29	-10	-40	-3
N2	1IVE	wt	ST3	-1	-9	16	5	1
N2	1IVE	wt	ST3-H	0	91	-148	164	15
N2	1ING A	wt	ST5	-1	-49	53	-33	-5
N2	1ING B	wt	ST5	-1	-49	53	-33	-4
N2	1ING averaged	wt	ST5	-1	-49	53	-33	-5
N2	1INH A	wt	ST6	0	49	-62	79	16
N2	1INH B	wt	ST6	0	49	-62	79	16
N2	1INH averaged	wt	ST6	0	49	-62	79	16
N6	1W1X A	wt	SIA	-1	-3	17	-5	2
N6	1W1X B	wt	SIA	-1	7	-4	-14	-
N6	1W1X C	wt	SIA	-1	1	11	2	-
N6	1W1X D	wt	SIA	-1	-2	14	-3	1
N6	1W20 IA	wt	SIA	-1	-2	13	4	2
N6	1W20 B	wt	SIA	-1	-2	13	1	1
N6	1W20 C	wt	SIA	-1	-2	14	2	2
N6	1W20 D	wt	SIA	-1	0	13	1	1
N6	1W21 A	wt	SIA	-1	-2	13	4	2
N6	1W21 B	wt	SIA	-1	-2	13	1	1
N6	1W21 C	wt	SIA	-1	-2	14	2	2
N6	1W21 D	wt	SIA	-1	0	13	1	1
N6	N6:SIA averaged	wt	SIA	-1	-1	12	0	1
N9	1MVE	wt	SIA	-1	2	7	3	1
N9	2QWB	Arg292Lys	SIA	-1	0	12	0	1
N9	1IN Y	Ser370Lys	EQP	-2	-11	22	-38	-4
N9	1IN Y	Ser370Lys	EQP-H	-1	-1	9	-26	-2
N9	1F8B	wt	DAN	-1	-11	24	-18	-
N9	1NNB	wt	DAN	-1	-13	37	-24	-
N9	N9:DAN averaged	wt	DAN	-1	-12	31	-21	-
N9	2QWC	Arg292Lys	DAN	-1	-6	18	-28	-1
N9	1F8C	wt	4AM	0	16	-16	-3	-
N9	2QWD	Arg292Lys	4AM	0	7	-2	11	3
N9	1F8D	wt	9AM	0	90	-118	136	20
N9	1F8E	wt	49A	1	114	-146	145	23
N9	1NNC	wt	GNA	0	21	-19	2	1
N9	2QWE	Arg292Lys	GNA	0	19	-21	4	3
N9	1BJI	wt	G21	0	29	-18	39	8
N9	2QWF	Arg292Lys	G20	0	24	-20	35	7
N9	2QWI	wt	G20	0	25	-20	30	7
N9	2QWG	Arg292Lys	G28	0	22	-9	21	6
N9	2QWJ	wt	G28	0	22	-9	20	7
N9	2QWH	Arg292Lys	G39	0	24	-23	35	6
N9	2QWK	wt	G39	0	25	-27	40	7
N9	1L7F	wt	BCZ	0	46	-64	70	8
N9	1L7G	Glu119Gly	BCZ	0	46	-64	69	8
N9	1L7H	Arg292Lys	BCZ	0	46	-65	71	9
N9	1XOE	wt	ABX	0	63	-87	91	11



N9	1XOG	wt	ABW	-1	40	-50	50	6
B	1NSC A	wt	SIA	-1	12	-9	-10	
B	1NSC B	wt	SIA	-1	12	-9	-10	
B	1NSC averaged	wt	SIA	-1	12	-9	-10	
B	1INV	wt	EQP	-2	-9	16	-29	-2
B	1INV	wt	EQP-H	-1	1	3	-16	-
B	1NSD A	wt	DAN	-1	-3	11	-28	-1
B	1NSD B	wt	DAN	-1	-3	12	-27	-1
B	1NSD averaged	wt	DAN	-1	-3	12	-27	-1
B	1A4G A	wt	ZMR	0	14	-6	11	3
B	1A4G B	wt	ZMR	0	14	-6	12	3
B	1A4G averaged	wt	ZMR	0	14	-6	11	3
B	1A4Q A	wt	DPC	0	29	-15	38	8
B	1A4Q B	wt	DPC	0	30	-18	39	8
B	1A4Q averaged	wt	DPC	0	29	-16	39	8
B	1IVB	wt	ST1	-1	-34	47	-47	-6
B	1INF	Arg382Lys	ST4	0	56	-70	85	13
B	1B9S	wt	FDI	-1	-39	60	-56	-2
B	1VCJ	wt	IBA	0	42	-61	89	11
B	1VCJ	wt	IBA-H	1	129	-192	229	25
B	1B9V	wt	RA2	-1	26	-33	50	8
B	1B9V	wt	RA2-H	0	114	-153	175	23
B	1B9T	wt	RAI	0	54	-68	85	12

**Table S10****O-group**

NA strain	structure		inhibitor	inh charge	ARG 118	ASP 151	ARG 152	ARG 224
N2	2BAT	Asp339Asn	SIA	-1	-50	59	-41	-43
N2	1INW	wt	AXP	-2	-50	57	-44	-43
N2	1INW	wt	AXP-H	-1	-49	56	-43	-43
N2	1INX	wt	EQP	-2	-49	64	-47	-43
N2	1INX	wt	EQP-H	-1	-49	64	-47	-42
N2	1IVF	wt	DAN	-1	-46	61	-42	-38
N2	1IVD	wt	ST1	-1	6	-7	8	9
N2	1IVC	wt	ST2	-1	2	-16	1	1
N2	1IVC	wt	ST2-H	0	13	-35	13	8
N2	1IVE	wt	ST3	-1	-2	3	1	1
N2	1IVE	wt	ST3-H	0	7	-12	11	9
N2	1ING A	wt	ST5	-1	4	-9	7	8
N2	1ING B	wt	ST5	-1	4	-9	7	8
N2	1ING averaged	wt	ST5	-1	4	-9	7	8
N2	1INH A	wt	ST6	0	9	-13	9	10
N2	1INH B	wt	ST6	0	9	-13	9	10
N2	1INH averaged	wt	ST6	0	9	-13	9	10
N6	1W1X A	wt	SIA	-1	-50	55	-41	-44
N6	1W1X B	wt	SIA	-1	-49	54	-42	-44
N6	1W1X C	wt	SIA	-1	-51	58	-42	-43
N6	1W1X D	wt	SIA	-1	-51	55	-41	-42
N6	1W20 IA	wt	SIA	-1	-51	58	-42	-43
N6	1W20 B	wt	SIA	-1	-50	56	-42	-43
N6	1W20 C	wt	SIA	-1	-50	57	-42	-43
N6	1W20 D	wt	SIA	-1	-51	57	-42	-43
N6	1W21 A	wt	SIA	-1	-51	58	-42	-43
N6	1W21 B	wt	SIA	-1	-50	56	-42	-43
N6	1W21 C	wt	SIA	-1	-50	57	-42	-43
N6	1W21 D	wt	SIA	-1	-51	57	-42	-43
N6	N6:SIA averaged	wt	SIA	-1	-50	57	-42	-43
N9	1MVE	wt	SIA	-1	-49	59	-43	-43
N9	2QWB	Arg292Lys	SIA	-1	-49	59	-43	-42
N9	1INY	Ser370Lys	EQP	-2	-47	57	-44	-42
N9	1INY	Ser370Lys	EQP-H	-1	-46	56	-44	-41
N9	1F8B	wt	DAN	-1	-45	56	-41	-39
N9	1NNB	wt	DAN	-1	-45	54	-40	-39
N9	N9:DAN averaged	wt	DAN	-1	-45	55	-40	-39
N9	2QWC	Arg292Lys	DAN	-1	-45	60	-41	-38
N9	1F8C	wt	4AM	0	-44	54	-40	-38
N9	2QWD	Arg292Lys	4AM	0	-45	58	-41	-37
N9	1F8D	wt	9AM	0	-44	56	-40	-37
N9	1F8E	wt	49A	1	-43	54	-39	-36
N9	1NNC	wt	GNA	0	-43	54	-38	-38
N9	2QWE	Arg292Lys	GNA	0	-43	58	-40	-37

N9	1BJI	wt	G21	0	-46	60	-40	-37
N9	2QWF	Arg292Lys	G20	0	-43	58	-41	-36
N9	2QWI	wt	G20	0	-44	61	-41	-37
N9	2QWG	Arg292Lys	G28	0	-46	61	-42	-37
N9	2QWJ	wt	G28	0	-46	58	-42	-37
N9	2QWH	Arg292Lys	G39	0	-51	58	-37	-33
N9	2QWK	wt	G39	0	-51	57	-37	-32
N9	1L7F	wt	BCZ	0	-11	-18	-13	-13
N9	1L7G	Glu119Gly	BCZ	0	-11	-19	-12	-13
N9	1L7H	Arg292Lys	BCZ	0	-11	-24	-12	-13
N9	1XOE	wt	ABX	0	28	-42	33	31
N9	1XOG	wt	ABW	-1	-50	63	-47	-43
B	1NSC A	wt	SIA	-1	-50	61	-43	-43
B	1NSC B	wt	SIA	-1	-50	63	-43	-43
B	1NSC averaged	wt	SIA	-1	-50	62	-43	-43
B	1INV	wt	EQP	-2	-50	66	-47	-43
B	1INV	wt	EQP-H	-1	-49	65	-46	-42
B	1NSD A	wt	DAN	-1	-45	56	-41	-40
B	1NSD B	wt	DAN	-1	-45	57	-40	-40
B	1NSD averaged	wt	DAN	-1	-45	57	-41	-40
B	1A4G A	wt	ZMR	0	-44	59	-40	-37
B	1A4G B	wt	ZMR	0	-44	56	-40	-37
B	1A4G averaged	wt	ZMR	0	-44	57	-40	-37
B	1A4Q A	wt	DPC	0	-46	60	-40	-37
B	1A4Q B	wt	DPC	0	-47	61	-41	-38
B	1A4Q averaged	wt	DPC	0	-46	60	-41	-38
B	1IVB	wt	ST1	-1	6	-8	7	9
B	1INF	Arg382Lys	ST4	0	9	-13	11	12
B	1B9S	wt	FDI	-1	-1	2	1	3
B	1VCJ	wt	IBA	0	1	-2	3	5
B	1VCJ	wt	IBA-H	1	6	-8	8	9
B	1B9V	wt	RA2	-1	-1	2	0	3
B	1B9V	wt	RA2-H	0	4	-4	5	8
B	1B9T	wt	RAI	0	9	-12	10	12