**Table ST2**

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|  | **ACAC** | | | **AUAU** | | |
|  | **Substrate** | **Residue** | **bond length**  **(% occupancy)** | **Substrate** | **Residue** | **bond length**  **(% occupancy)** |
| **bRNaseA** | C(-1) (N3)  C(-1) (O2)  A(1) (N1)  C(-1) (O2')  A(1) (N6) | Thr45 (Oϒ1)  Thr45 (N)  Asn71 (Nδ2)  Phe120 (O)  Asn71 (Oδ1) | 2.88 (91.4%)  2.88 (86.4%)  3.02 (58.7%)  2.74 (48.7%)  2.99 (46.3%) | A(1) (N1)  U(-1) (O2)  A(1) (N6)  U(-1) (N3) | Asn71 (Nδ2)  Thr45 (N)  Asn71 (Oδ1)  Thr45 (Oϒ1) | 3.02 (79.2%)  2.91 (78.8%)  2.96 (76.8%)  2.93 (74.9%) |
| **hRNase1** | C(-1) (N3)  C(-1) (O2)  A(1) (N1)  A(1) (N6)  C(-1)(O2') | Thr45 (Oϒ1)  Thr45 (N)  Asn71 (Nδ2)  Asn71 (Oδ1)  Phe120 (O) | 2.87 (93.6%)  2.88 (84.4%)  3.02 (70.1%)  2.98 (61.2%)  2.74 (45.4%) | U(-1) (N3)  A(1) (N1)  U(-1) (O2)  A(1) (N6)  U(-1) (O2') | Thr45 (Oϒ1)  Asn71 (Nδ2)  Thr45 (N)  Asn71 (Oδ1)  Phe120 (O) | 2.92 (93.9%)  3.00 (80.0%)  2.91 (76.9%)  2.97 (73.3%)  2.73 (52.0%) |
| **hRNase2** | A(1) (OP2)  C(-1) (N3) | Gln15 (Nε2)  Thr43 (Oϒ1) | 2.92 (56.4%)  2.84 (49.6%) | A(1) (OP2)  U(-1) (O2) | Gln15 (Nε2)  Thr43 (Oϒ1) | 2.94 (57.2%)  2.81 (56.8%) |
| **hRNase3** |  |  |  | A(1) (N1)  A(1) (O)  A(1) (OP2)  A(1) (N6) | Asn71 (Nδ2)  His129 (Nδ1)  Gln15 (Nε2)  Asn71 (Oδ1) | 2.98 (47.9%)  2.83 (47.4%)  2.89 (46.8%)  2.97 (45.1%) |
| **hRNase4** | C(-1) (N4)  A(1) (O)  A(1) (OP1) | Thr45 (Oϒ1)  Phe118 (N)  His117 (Nδ1) | 2.90 (86.0%)  2.92 (58.0%)  2.78 (49.4%) | U(-1) (N3)  U(-1) (O2)  A(1) (O)  A(1) (N1)  A(1) (N6)  A(1) (O) | Thr45 (Oϒ1)  Thr45 (N)  Phe118 (N)  Asn71 (Nδ2)  Asn71 (Oδ1)  His117 (Nδ1) | 2.94 (92.6%)  2.92 (88.1%)  2.88 (69.8%)  3.02 (48.7%)  2.96 (48.5%)  2.79 (47.4%) |
| **hRNase5** | C(-1) (N3)  C(-1) (O2) | Thr44 (Oϒ1)  Thr44 (N) | 2.85 (76.3%)  2.90 (70.7%) | U(-1) (O4)  U(-1) (N3) | Thr44 (N)  Asn43 (Oδ1) | 2.91 (56.9%)  2.92 (54.2%) |
| **hRNase6** | A(1) (N6)  A(1) (N1)  A(1) (O)  A(1) (O)  C(-1) (N4)  A(1) (N6) | Asn69 (Oδ1)  Asn69 (Nδ2)  Trp11 (Nε1)  Gln15 (Nε2)  Thr43 (Oϒ1)  Asn65 (Oδ1) | 2.97 (93.6%)  3.03 (90.4%)  2.87 (87.2%)  2.97 (70.6%)  2.95 (48.2%)  2.97 (47.2%) | A(1) (N6)  A(1) (N1)  A(1) (N6)  A(1) (O) | Asn69 (Oδ1)  Asn69 (Nδ2)  Asn65 (Oδ1)  Gln15 (Nε2) | 2.95 (95.6%)  3.05 (85.0%)  2.95 (59.2%)  2.90 (46.7%) |
| **hRNase7** | C(-1) (N3)  C(-1) (O2)  C(-1) (O2')  C(-1) (N4) | Thr43 (Oϒ1)  Thr43 (N)  Leu125 (O)  Thr43 (Oϒ1) | 2.83 (81.3%)  2.94 (74.8%)  2.71 (60.2%)  3.04 (50.6%) |  |  |  |