

**NON COVALENT INCLUSION OF NUCLEOSIDES AND  
NUCLEOTIDES IN WATER-SOLUBLE MOLECULAR CLIPS.**

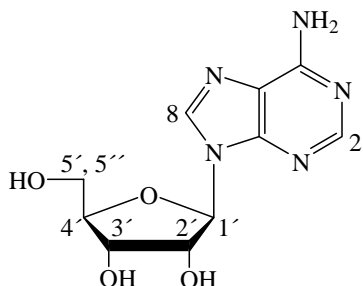
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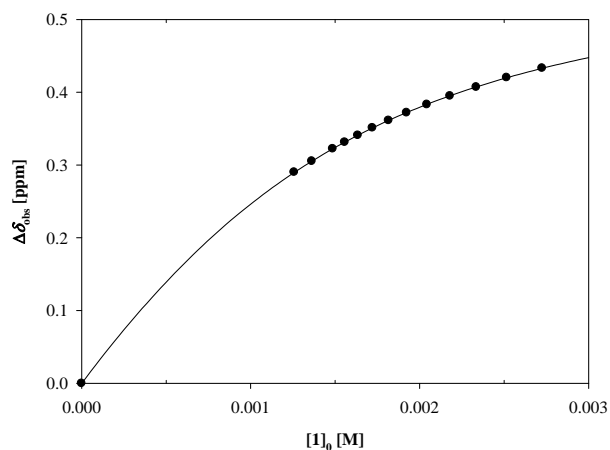
**Supporting Information**

**<sup>1</sup>H-NMR titration experiments with phosphate clip 1:**

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	267.10
$T$ [°C]	25	$m_R$ [mg]	1.02
substrate	adenosine ( <b>A</b> )	$m_S$ [mg]	0.83
	$\delta_0$ (1'-H) [ppm] = 6.072	$V_0$ [mL]	2.5
	$\delta_0$ (3'-H) [ppm] = 4.429	$[S]_0$ [mM]	1.23
	$\delta_0$ (4'-H) [ppm] = 4.292		
	$\delta_0$ (5'-H, 5''-H) [ppm] = 3.832, 3.910		
	$\delta_0$ (2-H) [ppm] = 8.338		
	$\delta_0$ (8-H) [ppm] = 8.253		



$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	2.72	5.639	0.433	0.433
0.65	2.52	5.652	0.420	0.420
0.70	2.34	5.665	0.407	0.407
0.75	2.18	5.677	0.395	0.395
0.80	2.04	5.689	0.383	0.383
0.85	1.92	5.700	0.372	0.372
0.90	1.82	5.711	0.361	0.361
0.95	1.72	5.721	0.351	0.351
1.00	1.63	5.731	0.341	0.341
1.05	1.56	5.740	0.331	0.332
1.10	1.49	5.749	0.322	0.322
1.20	1.36	5.767	0.305	0.305
1.30	1.26	5.782	0.290	0.290



$$K_a [M^{-1}] = 1470 \pm 300$$

$$\Delta\delta_{\max} (1'-H) [\text{ppm}] = 0.60$$

$$\Delta\delta_{\max} (3'-H) [\text{ppm}] = 0.06$$

$$\Delta\delta_{\max} (4'-H) [\text{ppm}] = 0.11$$

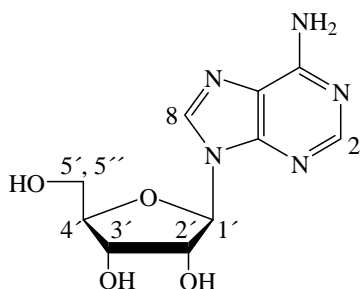
$$\Delta\delta_{\max} (5'-H, 5''-H) [\text{ppm}] = -0.08, -0.13$$

$$\Delta\delta_{\max} (2-H) [\text{ppm}] = 2.20$$

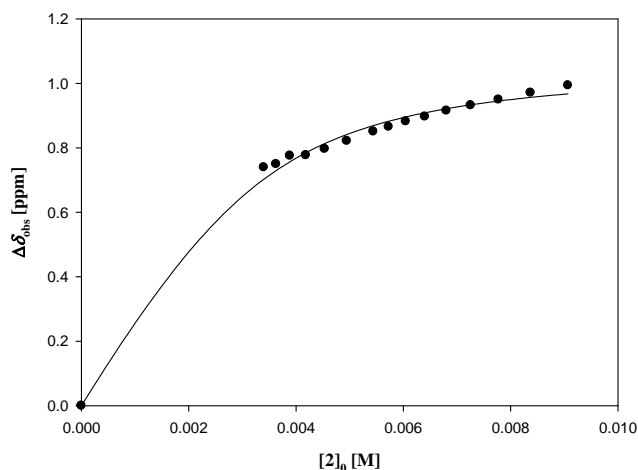
$$\Delta\delta_{\max} (8-H) [\text{ppm}] = 2.15$$

### <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	267.10
$T$ [°C]	25	$m_R$ [mg]	1.02
substrate	adenosine (A)	$m_S$ [mg]	0.83
	$\delta_0 (1'-H)$ [ppm] = 6.072	$V_0$ [mL]	2.5
	$\delta_0 (3'-H)$ [ppm] = 4.429	$[S]_0$ [mM]	1.23
	$\delta_0 (4'-H)$ [ppm] = 4.292		
	$\delta_0 (5'-H, 5''-H)$ [ppm] = 3.832, 3.910		
	$\delta_0 (2-H)$ [ppm] = 8.338		
	$\delta_0 (8-H)$ [ppm] = 8.253		



$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}} (2-H)$	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	8.84	7.344	0.993	0.967
0.65	8.16	7.367	0.971	0.957
0.70	7.58	7.388	0.949	0.945
0.75	7.07	7.406	0.932	0.933
0.80	6.63	7.422	0.915	0.921
0.85	6.24	7.441	0.897	0.909
0.90	5.89	7.455	0.882	0.896
0.95	5.58	7.472	0.865	0.882
1.00	5.31	7.487	0.850	0.869
1.10	4.82	7.516	0.822	0.841
1.20	4.42	7.541	0.797	0.813
1.30	4.08	7.560	0.777	0.785
1.40	3.79	7.562	0.775	0.757
1.50	3.54	7.588	0.749	0.729
1.60	3.32	7.598	0.740	0.703



$$K_a [M^{-1}] = 1120 \pm 150$$

$$\Delta\delta_{\max} (1\text{'-H}) [\text{ppm}] = 0.44$$

$$\Delta\delta_{\max} (2\text{-H}) [\text{ppm}] = 1.13$$

$$\Delta\delta_{\max} (8\text{-H}) [\text{ppm}] = 1.59$$

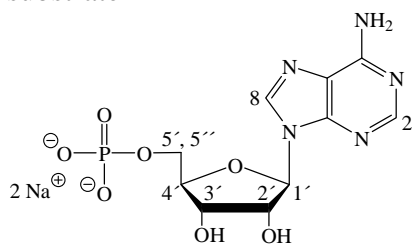
### <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor  
solvent  
 $T$  [°C]  
substrate

**Clip 1**  
phosphate buffer  
25

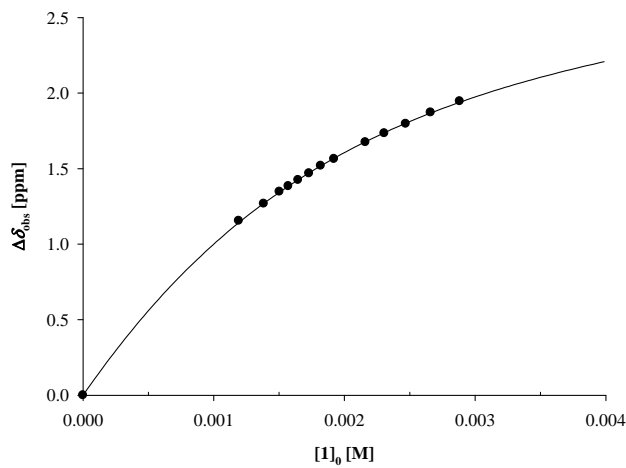
**AMP**

$M_R$  [g/mol] 622.13  
 $M_S$  [g/mol] 347.06  
 $m_R$  [mg] 1.08  
 $m_S$  [mg] 0.84  
 $V_0$  [mL] 2  
 $[S]_0$  [mM] 1.19



$\delta_0 (1\text{'-H})$  [ppm] = 6.134  
 $\delta_0 (3\text{'-H})$  [ppm] = 4.505  
 $\delta_0 (4\text{'-H})$  [ppm] = 4.364  
 $\delta_0 (5\text{'-H}, 5\text{'\text{-}H})$  [ppm] = 4.017  
 $\delta_0 (2\text{-H})$  [ppm] = 8.589  
 $\delta_0 (8\text{-H})$  [ppm] = 8.257

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}} (8\text{-H})$	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	2.88	6.312	1.946	1.939
0.65	2.66	6.386	1.872	1.868
0.70	2.47	6.461	1.797	1.801
0.75	2.31	6.523	1.734	1.738
0.80	2.16	6.582	1.675	1.678
0.90	1.92	6.694	1.564	1.569
0.95	1.82	6.739	1.519	1.519
1.00	1.73	6.789	1.469	1.471
1.05	1.65	6.832	1.425	1.427
1.10	1.57	6.874	1.384	1.384
1.15	1.50	6.910	1.347	1.344
1.25	1.38	6.990	1.268	1.270
1.35	1.28	-	-	-
1.45	1.19	7.103	1.155	1.143



$$K_a [\text{M}^{-1}] = 683 \pm 60$$

$$\Delta\delta_{\text{max}} (1'\text{-H}) [\text{ppm}] = 0.48$$

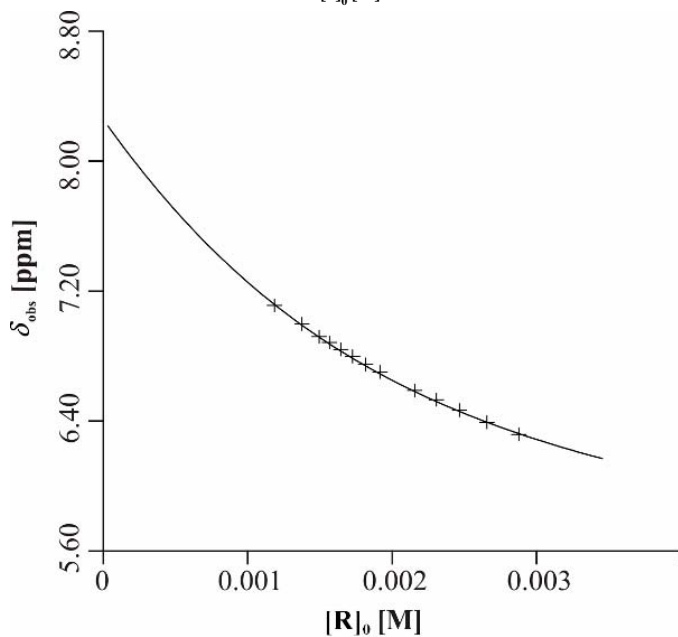
$$\Delta\delta_{\text{max}} (3'\text{-H}) [\text{ppm}] = 0.08$$

$$\Delta\delta_{\text{max}} (4'\text{-H}) [\text{ppm}] = 0.02$$

$$\Delta\delta_{\text{max}} (5'\text{-H}, 5''\text{-H}) [\text{ppm}] = -0.06, -0.14$$

$$\Delta\delta_{\text{max}} (2\text{-H}) [\text{ppm}] = 0.74$$

$$\Delta\delta_{\text{max}} (8\text{-H}) [\text{ppm}] = 3.14$$



evaluation of the signals of the proton 8-H with the computer programme HOSTEST assuming a 1:1 complex stoichiometry

$$K_a [\text{M}^{-1}] = 776 \pm 162^*$$

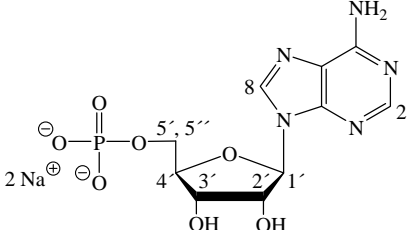
$$\Delta\delta_{\text{max}} (8\text{-H}) [\text{ppm}] = 3.10$$

\* limit of the 95% confidence interval

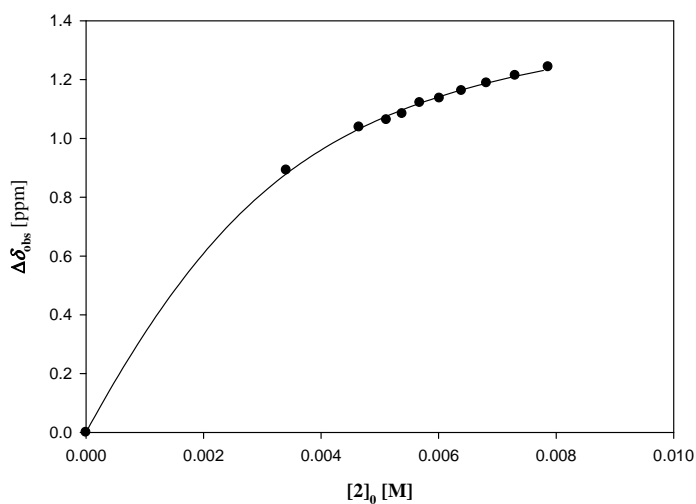
## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	347.06
$T$ [°C]	25	$m_R$ [mg]	3.10
substrate	<b>AMP</b>	$m_S$ [mg]	3.00
		$V_0$ [mL]	3
		$[S]_0$ [mM]	2.88

	$\delta_0$ (1'-H) [ppm] = 6.134
	$\delta_0$ (3'-H) [ppm] = 4.505
	$\delta_0$ (4'-H) [ppm] = 4.364
	$\delta_0$ (5'-H, 5''-H) [ppm] = 4.017
	$\delta_0$ (2-H) [ppm] = 8.589
	$\delta_0$ (8-H) [ppm] = 8.257

$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (8-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	8.50	7.032	1.226	1.234
0.65	7.90	7.014	1.243	1.234
0.70	7.30	7.043	1.214	1.211
0.75	6.80	7.069	1.188	1.187
0.80	6.40	7.095	1.162	1.164
0.85	6.00	7.121	1.137	1.142
0.90	5.70	7.136	1.121	1.119
0.95	5.40	7.174	1.084	1.097
1.00	5.10	7.194	1.063	1.075
1.10	4.60	-	-	-
1.20	4.30	-	-	-
1.30	3.90	-	-	-
1.40	3.70	-	-	-
1.50	3.40	7.365	0.892	1.032
1.60	3.20	7.366	0.892	0.879
1.80	2.80	-	-	-



$$K_a [M^{-1}] = 910 \pm 80$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.27$$

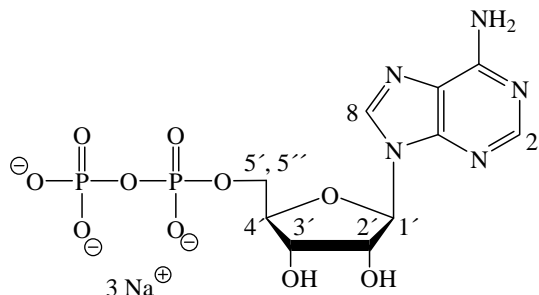
$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.07$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 0.38$$

$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 1.51$$

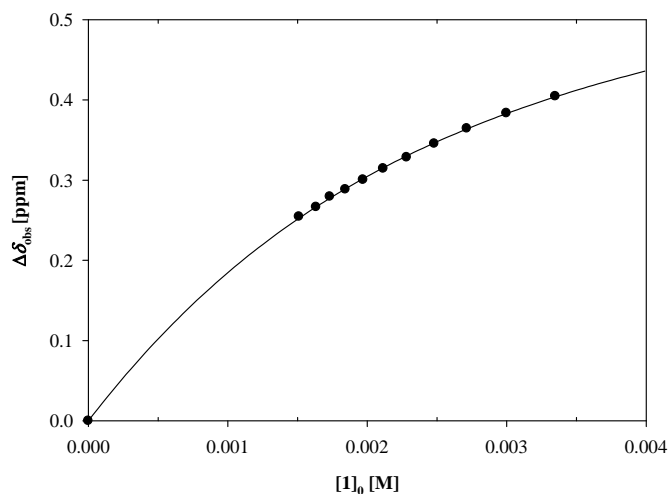
## <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	501.01
$T$ [°C]	25	$m_R$ [mg]	1.25
substrate	ADP	$m_S$ [mg]	2.60



$\delta_0$ (1'-H) [ppm]	= 6.136	$V_0$ [mL]	4
$\delta_0$ (3'-H) [ppm]	= 4.590	$[S]_0$ [mM]	1.27
$\delta_0$ (4'-H) [ppm]	= 4.370		
$\delta_0$ (2-H) [ppm]	= 8.523		
$\delta_0$ (8-H) [ppm]	= 8.254		

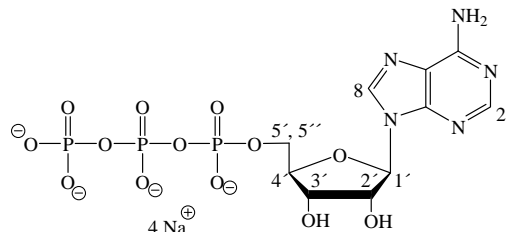
$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	3.35	8.118	0.405	0.404
0.67	3.00	8.139	0.384	0.383
0.74	2.71	8.158	0.365	0.364
0.81	2.48	8.177	0.346	0.346
0.88	2.28	8.194	0.329	0.330
0.95	2.11	8.208	0.315	0.315
1.02	1.97	8.222	0.301	0.302
1.09	1.84	8.234	0.289	0.289
1.16	1.73	8.243	0.280	0.277
1.23	1.63	8.256	0.267	0.267
1.33	1.51	8.268	0.255	0.252



$$K_a [M^{-1}] = 630 \pm 60$$
$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.54$$
$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.08$$
$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.00$$
$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 0.67$$
$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 3.68$$

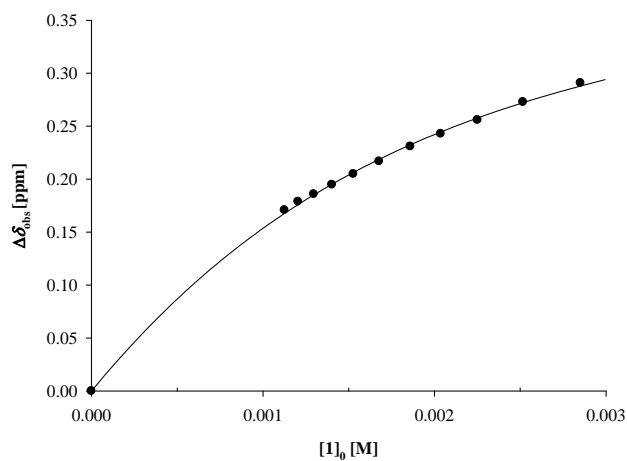
# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	550.96
$T$ [°C]	25	$m_R$ [mg]	1.06
substrate	ATP	$m_S$ [mg]	2.59



$\delta_0$ (1'-H) [ppm]	= 6.135	$V_0$ [mL]	4
$\delta_0$ (3'-H) [ppm]	= 4.602	$[S]_0$ [mM]	1.07
$\delta_0$ (4'-H) [ppm]	= 4.389		
$\delta_0$ (5'-H, 5''-H) [ppm]	= 4.199, 4.278		
$\delta_0$ (2-H) [ppm]	= 8.540		
$\delta_0$ (8-H) [ppm]	= 8.256		

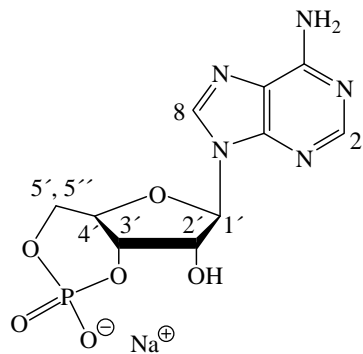
$V$ [mL]	$[1]_0$ [mM]	$\delta_{obs}$ (1'-H)	$\Delta\delta_{obs}$	$\Delta\delta_{calc}$
0.60	2.85	5.844	0.291	0.288
0.68	2.52	5.862	0.273	0.272
0.76	2.25	5.879	0.256	0.258
0.84	2.04	5.892	0.243	0.245
0.92	1.86	5.904	0.231	0.232
1.02	1.68	5.918	0.217	0.219
1.12	1.53	5.930	0.205	0.206
1.22	1.40	5.940	0.195	0.195
1.32	1.30	5.949	0.186	0.185
1.42	1.20	5.956	0.179	0.176
1.52	1.13	5.964	0.171	0.168



$K_a$ [ $M^{-1}$ ]	=	$810 \pm 110$
$\Delta\delta_{max}$ (1'-H) [ppm]	=	0.45
$\Delta\delta_{max}$ (3'-H) [ppm]	=	0.07
$\Delta\delta_{max}$ (4'-H) [ppm]	=	0.00
$\Delta\delta_{max}$ (5'-H, 5''-H) [ppm]	=	- 0.02, - 0.14
$\Delta\delta_{max}$ (2-H) [ppm]	=	0.56
$\Delta\delta_{max}$ (8-H) [ppm]	=	3.14

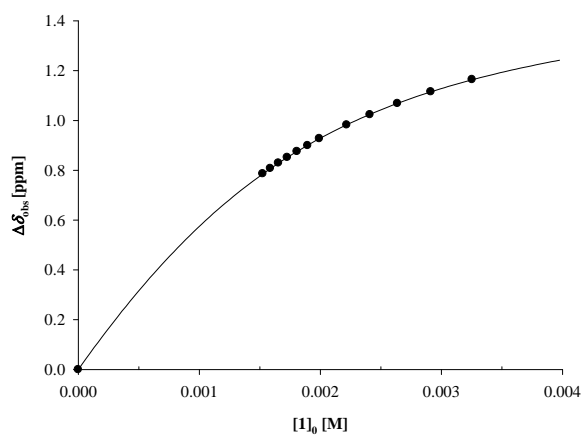
## <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	329.05
$T$ [°C]	25	$m_R$ [mg]	0.79
substrate	<b>cAMP</b>	$m_S$ [mg]	2.05



$\delta_0$ (1'-H) [ppm] = 6.200	$V_0$ [mL]	4
$\delta_0$ (2-H) [ppm] = 8.247	$[S]_0$ [mM]	1.53
$\delta_0$ (8-H) [ppm] = 8.263		

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	3.25	7.083	1.164	1.163
0.67	2.91	7.132	1.115	1.115
0.74	2.64	7.179	1.068	1.069
0.81	2.41	7.224	1.023	1.025
0.88	2.22	7.265	0.982	0.983
0.93	2.10	-	-	-
0.98	1.99	7.320	0.927	0.927
1.03	1.89	7.348	0.899	0.901
1.08	1.81	7.372	0.875	0.876
1.13	1.73	7.396	0.851	0.851
1.18	1.65	7.418	0.829	0.828
1.23	1.59	7.440	0.807	0.806
1.28	1.52	7.461	0.786	0.785



$$K_a [M^{-1}] = 1260 \pm 10$$

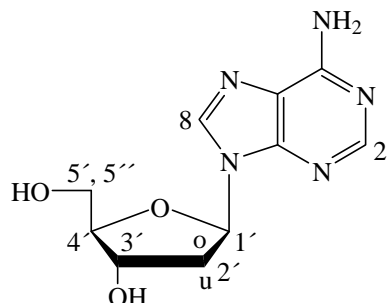
$$\Delta\delta_{\text{max}} (1'-\text{H}) [\text{ppm}] = 0.76$$

$$\Delta\delta_{\text{max}} (2-\text{H}) [\text{ppm}] = 1.60$$

$$\Delta\delta_{\text{max}} (8-\text{H}) [\text{ppm}] = 3.11$$

# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

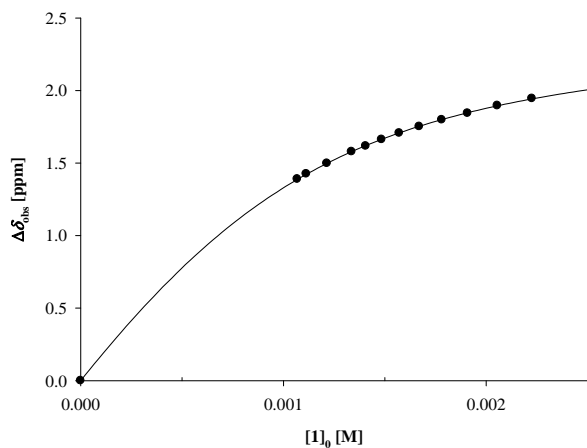
receptor	<b>Clip 1</b>	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	349.08
$T$ [°C]	25	$m_R$ [mg]	0.82
substrate	<b>DA</b>	$m_S$ [mg]	0.73



$\delta_0$ (1'-H) [ppm]	= 6.484
$\delta_0$ (3'-H) [ppm]	= 4.650
$\delta_0$ (4'-H) [ppm]	= 4.186
$\delta_0$ (5'-H, 5''-H) [ppm]	= 3.777, 3.838
$\delta_0$ (2-H) [ppm]	= 8.323
$\delta_0$ (8-H) [ppm]	= 8.242

$V_0$ [mL]	2
$[S]_0$ [mM]	1.04

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	2.23	6.377	1.946	1.942
0.65	2.05	6.426	1.897	1.895
0.70	1.91	6.478	1.844	1.847
0.75	1.78	6.524	1.798	1.800
0.80	1.67	6.571	1.751	1.754
0.85	1.57	6.616	1.707	1.708
0.90	1.48	6.660	1.663	1.664
0.95	1.41	6.705	1.617	1.620
1.00	1.34	6.744	1.579	1.578
1.10	1.21	6.824	1.498	1.498
1.20	1.11	6.897	1.426	1.423
1.25	1.07	6.933	1.390	1.387
1.30	1.03	-	-	-



$$K_a [M^{-1}] = 3150 \pm 540$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.98$$

$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.14$$

$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.13$$

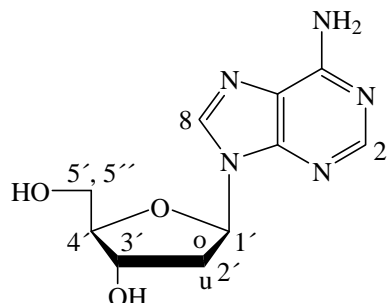
$$\Delta\delta_{\text{max}} (5'-H, 5''-H) [\text{ppm}] = -0.01, -0.03$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 2.46$$

$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 2.15$$

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

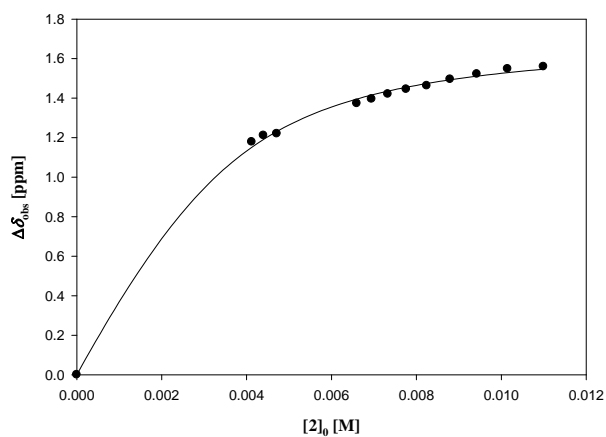
receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	349.08
$T$ [°C]	25	$m_R$ [mg]	2.70
substrate	DA	$m_S$ [mg]	4.00



$\delta_0$ (1'-H) [ppm]	= 6.484
$\delta_0$ (3'-H) [ppm]	= 4.650
$\delta_0$ (4'-H) [ppm]	= 4.186
$\delta_0$ (5'-H, 5''-H) [ppm]	= 3.777, 3.838
$\delta_0$ (2-H) [ppm]	= 8.323
$\delta_0$ (8-H) [ppm]	= 8.242

$V_0$ [mL]	3
$[S]_0$ [mM]	3.58

$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (8-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	11.00	6.683	1.559	1.546
0.65	10.10	6.694	1.548	1.529
0.70	9.40	6.720	1.522	1.511
0.75	8.80	6.747	1.496	1.493
0.80	8.80	6.780	1.463	1.474
0.85	7.80	6.798	1.445	1.455
0.90	7.30	6.822	1.420	1.435
0.95	6.90	6.847	1.396	1.416
1.00	6.60	6.869	1.373	1.396
1.10	6.00	-	-	-
1.20	6.00	-	-	-
1.30	5.10	-	-	-
1.40	4.70	7.022	1.231	1.231
1.50	4.40	7.031	1.191	1.151
1.60	4.10	7.064	1.151	1.151



$$K_a [M^{-1}] = 840 \pm 130$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.98$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 2.39$$

$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 1.67$$

# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor  
solvent  
 $T$  [°C]  
substrate

## Clip 1

phosphate buffer

25

## DAMP

$\delta_0$  (1'-H) [ppm] = 6.513

$\delta_0$  (2'-o-H) [ppm] = 2.835

$\delta_0$  (2'-u-H) [ppm] = 2.580

$\delta_0$  (3'-H) [ppm] = 4.719

$\delta_0$  (4'-H) [ppm] = 4.258

$\delta_0$  (2-H) [ppm] = 8.533

$\delta_0$  (8-H) [ppm] = 8.249

$M_R$  [g/mol] 622.13

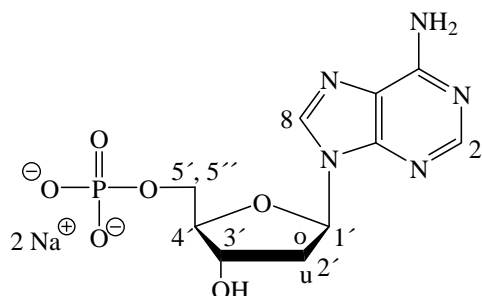
$M_S$  [g/mol] 349.08

$m_R$  [mg] 0.63

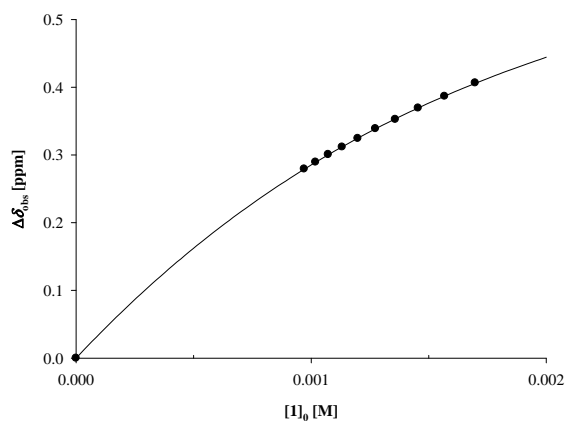
$m_S$  [mg] 0.75

$V_0$  [mL] 2

$[S]_0$  [mM] 1.05



$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	1.70	8.126	0.406	0.406
0.65	1.57	8.146	0.387	0.387
0.70	1.46	8.163	0.369	0.369
0.75	1.36	8.180	0.353	0.353
0.80	1.27	8.194	0.339	0.339
0.85	1.20	8.208	0.324	0.325
0.90	1.13	8.221	0.312	0.312
0.95	1.07	8.232	0.301	0.300
1.00	1.02	8.243	0.289	0.289
1.05	0.97	8.253	0.279	0.279



$$K_a [M^{-1}] = 920 \pm 20$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.60$$

$$\Delta\delta_{\text{max}} (2'-o-H) [\text{ppm}] = 0.05$$

$$\Delta\delta_{\text{max}} (2'-u-H) [\text{ppm}] = 0.33$$

$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.06$$

$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.03$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 0.79$$

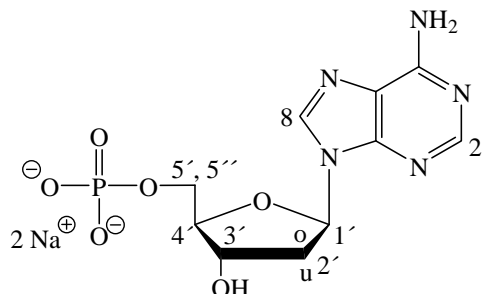
$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 3.44$$

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor  
solvent  
 $T$  [°C]  
substrate

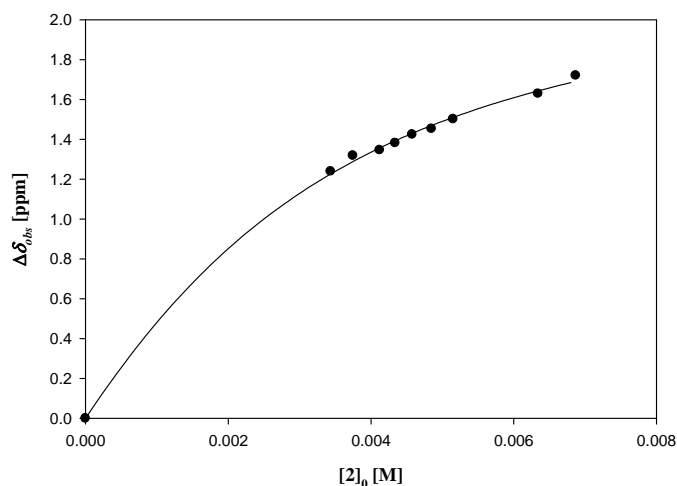
Clip 2  
phosphate buffer

$M_R$  [g/mol] 606.41  
 $M_S$  [g/mol] 349.08  
 $m_R$  [mg] 2.50  
 $m_S$  [mg] 2.28  
 $V_0$  [mL] 3  
 $[S]_0$  [mM] 2.29



**DAMP**  
 $\delta_0$  (1'-H) [ppm] = 6.513  
 $\delta_0$  (2'-o-H) [ppm] = 2.835  
 $\delta_0$  (2'-u-H) [ppm] = 2.580  
 $\delta_0$  (3'-H) [ppm] = 4.719  
 $\delta_0$  (4'-H) [ppm] = 4.258  
 $\delta_0$  (2-H) [ppm] = 8.533  
 $\delta_0$  (8-H) [ppm] = 8.249

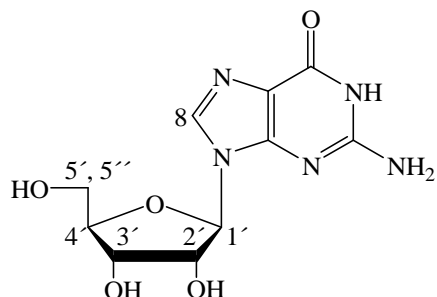
$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (8-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	6.90	6.530	1.719	1.691
0.65	6.30	6.621	1.629	1.643
0.70	5.90	-	-	-
0.75	5.50	-	-	-
0.80	5.20	6.748	1.501	1.511
0.85	4.90	6.797	1.453	1.470
0.90	4.60	6.825	1.424	1.431
0.95	4.30	6.868	1.381	1.431
1.00	4.10	6.903	1.346	1.357
1.10	3.70	6.931	1.319	1.289
1.05	3.40	7.010	1.239	1.226



$K_a$  [ $M^{-1}$ ] =  $650 \pm 70$   
 $\Delta\delta_{\text{max}}$  (1'-H) [ppm] = 1.00  
 $\Delta\delta_{\text{max}}$  (3'-H) [ppm] = 0.28  
 $\Delta\delta_{\text{max}}$  (4'-H) [ppm] = 0.24  
 $\Delta\delta_{\text{max}}$  (5'-H) [ppm] = 0.20  
 $\Delta\delta_{\text{max}}$  (5''-H) [ppm] = 0.24  
 $\Delta\delta_{\text{max}}$  (2-H) [ppm] = 1.74  
 $\Delta\delta_{\text{max}}$  (8-H) [ppm] = 2.36

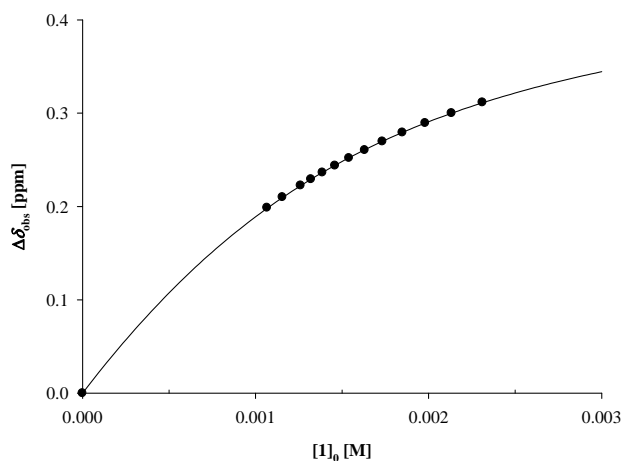
## <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	283.09
$T$ [°C]	25	$m_R$ [mg]	0.86
substrate	guanosine (G)	$m_S$ [mg]	0.83



$\delta_0$ (1'-H) [ppm]	= 5.908	$V_0$ [mL]	2.5
$\delta_0$ (2'-H) [ppm]	= 4.729	$[S]_0$ [mM]	1.15
$\delta_0$ (3'-H) [ppm]	= 4.403		
$\delta_0$ (4'-H) [ppm]	= 4.229		
$\delta_0$ (5'-H, 5''-H) [ppm]	= 3.812, 3.881		
$\delta_0$ (8-H) [ppm]	= 7.995		

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	2.31	5.596	0.312	0.311
0.65	2.13	5.608	0.300	0.300
0.70	1.98	5.618	0.289	0.289
0.75	1.85	5.629	0.279	0.279
0.80	1.73	5.638	0.270	0.270
0.85	1.63	5.647	0.260	0.261
0.90	1.54	5.656	0.252	0.252
0.95	1.46	5.664	0.244	0.244
1.00	1.39	5.671	0.236	0.236
1.05	1.32	5.679	0.229	0.229
1.10	1.26	5.685	0.223	0.222
1.20	1.16	5.698	0.210	0.210
1.30	1.07	5.709	0.199	0.198



$$K_a [M^{-1}] = 1120 \pm 110$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.48$$

$$\Delta\delta_{\text{max}} (2'-H) [\text{ppm}] = 0.34$$

$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.09$$

$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.07$$

$$\Delta\delta_{\text{max}} (5'-H, 5''-H) [\text{ppm}] = -0.06, 0.03$$

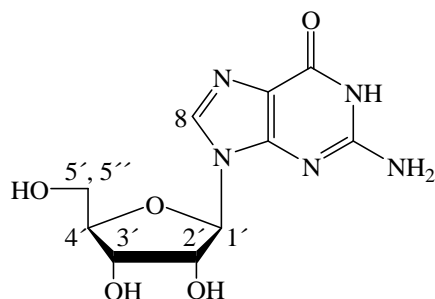
$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 0.82$$

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor  
solvent  
 $T$  [°C]  
substrate

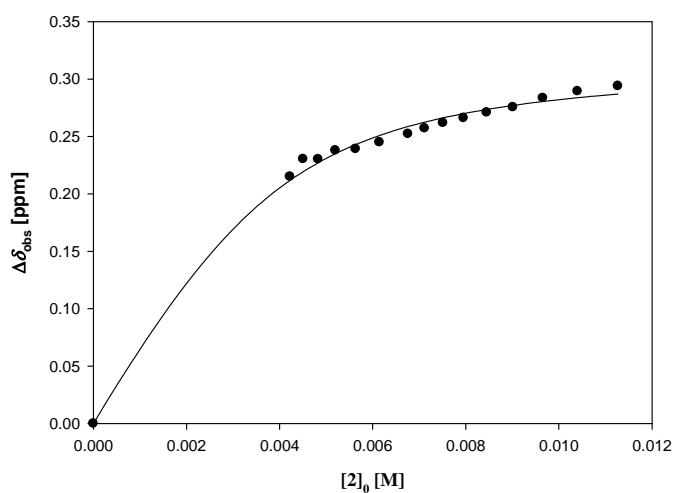
Clip 2  
phosphate buffer  
25  
guanosine (G)

$M_R$  [g/mol] 606.41  
 $M_S$  [g/mol] 283.09  
 $m_R$  [mg] 4.10  
 $m_S$  [mg] 3.30  
 $V_0$  [mL] 3.0  
 $[S]_0$  [mM] 3.88



$\delta_0$  (1'-H) [ppm] = 5.908  
 $\delta_0$  (2'-H) [ppm] = 4.729  
 $\delta_0$  (3'-H) [ppm] = 4.403  
 $\delta_0$  (4'-H) [ppm] = 4.229  
 $\delta_0$  (5'-H, 5''-H) [ppm] = 3.812, 3.881  
 $\delta_0$  (8-H) [ppm] = 7.995

$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	1127	5.614	0.294	0.287
0.65	10.40	5.618	0.289	0.284
0.70	9.66	5.624	0.283	0.280
0.75	9.01	5.632	0.275	0.277
0.80	8.45	5.637	0.271	0.273
0.85	7.95	5.642	0.266	0.270
0.90	7.51	5.646	0.262	0.266
0.95	7.12	5.651	0.257	0.2625
1.00	6.76	5.655	0.252	0.259
1.10	6.15	5.663	0.245	0.251
1.20	5.63	5.669	0.239	0.243
1.30	5.20	5.670	0.238	0.235
1.40	4.83	5.678	0.230	0.227
1.50	4.51	5.677	0.230	0.219
1.60	4.23	5.693	0.215	0.212



$K_a$  [ $M^{-1}$ ] =  $750 \pm 90$   
 $\Delta\delta_{\text{max}}$  (1'-H) [ppm] = 0.34  
 $\Delta\delta_{\text{max}}$  (2'-H) [ppm] = 0.27  
 $\Delta\delta_{\text{max}}$  (3'-H) [ppm] = 0.12  
 $\Delta\delta_{\text{max}}$  (4'-H) [ppm] = 0.07  
 $\Delta\delta_{\text{max}}$  (8-H) [ppm] = 0.47

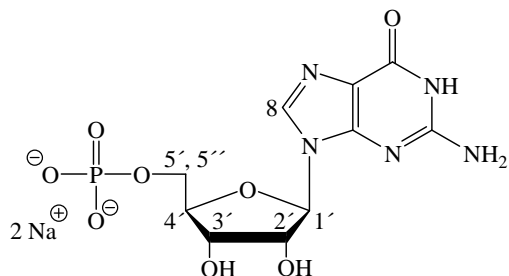
# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor  
solvent  
 $T$  [°C]  
substrate

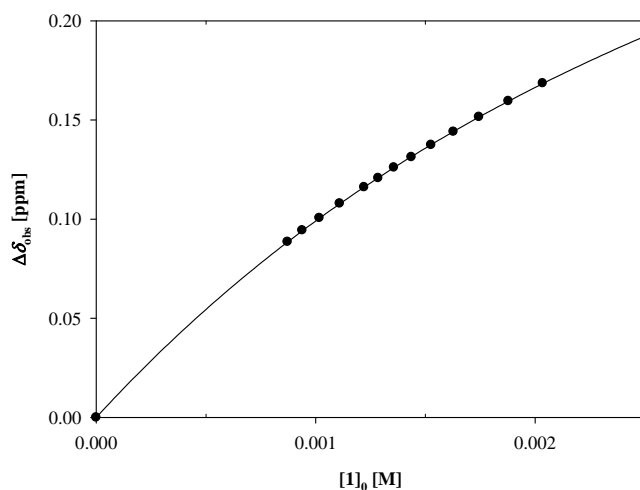
Clip 1  
phosphate buffer  
25

$M_R$  [g/mol] 622.13  
 $M_S$  [g/mol] 407.02  
 $m_R$  [mg] 0.76  
 $m_S$  [mg] 0.67  
 $V_0$  [mL] 2  
 $[S]_0$  [mM] 0.82

**GMP**  
 $\delta_0(1'-H) = 5.932$   
 $\delta_0(3'-H) = 4.480$   
 $\delta_0(4'-H) = 4.317$   
 $\delta_0(8-H) = 8.192$



$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}(1'-H)$	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	2.03	5.764	0.169	0.168
0.65	1.88	5.773	0.160	0.160
0.70	1.74	5.781	0.152	0.151
0.75	1.63	5.788	0.144	0.144
0.80	1.53	5.795	0.137	0.138
0.85	1.44	5.801	0.131	0.132
0.90	1.36	5.806	0.126	0.126
0.95	1.29	5.811	0.121	0.121
1.00	1.22	5.816	0.116	0.116
1.10	1.11	5.824	0.108	0.108
1.20	1.02	5.832	0.101	0.100
1.30	0.94	5.838	0.094	0.094
1.40	0.87	5.844	0.089	0.088



$$K_a [M^{-1}] = 350 \pm 20$$

$$\Delta\delta_{\text{max}}(1'-H) [\text{ppm}] = 0.46$$

$$\Delta\delta_{\text{max}}(3'-H) [\text{ppm}] = 0.07$$

$$\Delta\delta_{\text{max}}(4'-H) [\text{ppm}] = 0.02$$

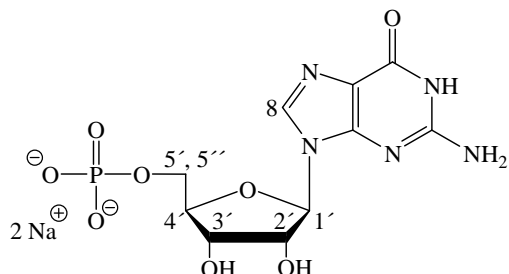
$$\Delta\delta_{\text{max}}(8-H) [\text{ppm}] = 0.37$$

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

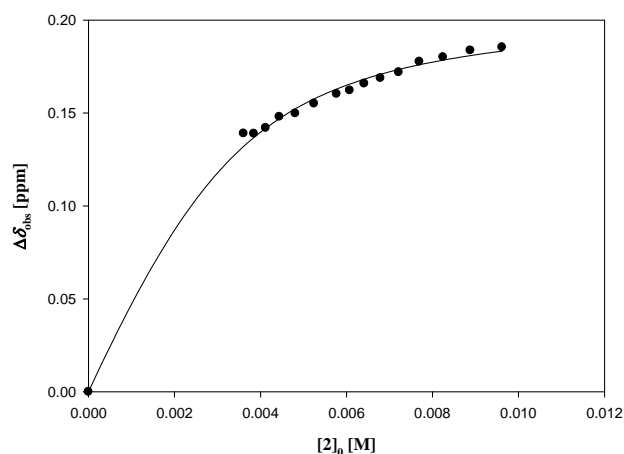
receptor  
solvent  
 $T$  [°C]  
substrate

Clip 2  
phosphate buffer  
25  
**GMP**  
 $\delta_0$  (1'-H) = 5.932  
 $\delta_0$  (3'-H) = 4.480  
 $\delta_0$  (4'-H) = 4.317  
 $\delta_0$  (8-H) = 8.192

$M_R$  [g/mol] 606.41  
 $M_S$  [g/mol] 407.02  
 $m_R$  [mg] 3.50  
 $m_S$  [mg] 4.00  
 $V_0$  [mL] 3  
 $[S]_0$  [mM] 3.27



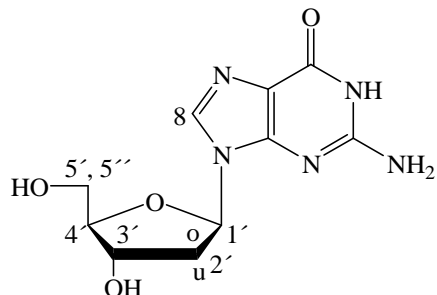
$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	9.62	5.747	0.185	0.183
0.65	8.88	5.748	0.184	0.181
0.70	8.25	5.752	0.180	0.178
0.75	7.70	5.754	0.178	0.176
0.80	7.21	5.760	0.172	0.173
0.85	6.79	5.763	0.169	0.171
0.90	6.41	5.766	0.166	0.168
0.95	6.08	5.770	0.162	0.166
1.00	5.77	5.772	0.160	0.163
1.10	5.25	5.777	0.155	0.158
1.20	4.81	5.782	0.150	0.152
1.30	4.44	5.784	0.148	0.147
1.40	4.12	5.790	0.142	0.142
1.50	3.85	5.793	0.139	0.137
1.60	3.61	5.793	0.139	0.132



$$K_a [M^{-1}] = 1140 \pm 130$$
$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.21$$
$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.06$$
$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.04$$
$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 0.17$$

### <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

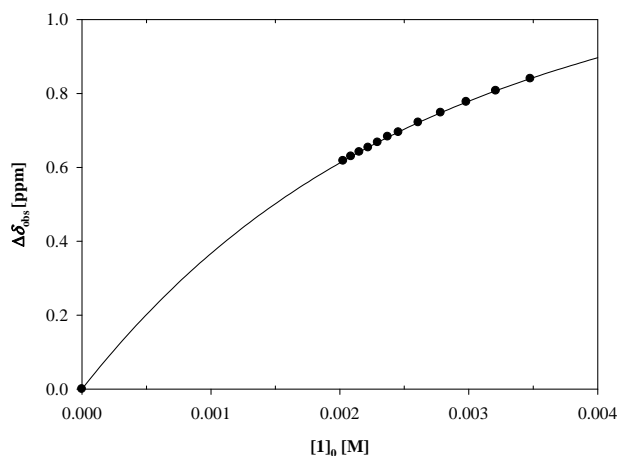
receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	267.10
$T$ [°C]	25	$m_R$ [mg]	1.41
substrate	<b>DG</b>	$m_S$ [mg]	0.64



$\delta_0$ (1'-H) [ppm]	= 6.301
$\delta_0$ (2'-o-H) [ppm]	= 2.504
$\delta_0$ (3'-H) [ppm]	= 4.617
$\delta_0$ (4'-H) [ppm]	= 4.123
$\delta_0$ (5'-H, 5''-H) [ppm]	= 3.752, 3.812
$\delta_0$ (8-H) [ppm]	= 7.979

$V_0$ [mL]	2
$[S]_0$ [mM]	1.21

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (8-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	3.48	7.140	0.840	0.840
0.65	3.21	7.172	0.807	0.807
0.70	2.98	7.202	0.777	0.777
0.75	2.78	7.231	0.748	0.748
0.80	2.61	7.258	0.721	0.721
0.85	2.46	7.285	0.695	0.695
0.88	2.37	7.297	0.683	0.682
0.91	2.29	7.312	0.667	0.668
0.94	2.22	7.326	0.654	0.654
0.97	2.15	7.338	0.642	0.642
1.00	2.09	7.350	0.630	0.629
1.03	2.03	7.362	0.618	0.617



$$K_a [M^{-1}] = 490 \pm 30$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 1.03$$

$$\Delta\delta_{\text{max}} (2'-o-H) [\text{ppm}] = 0.36$$

$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.21$$

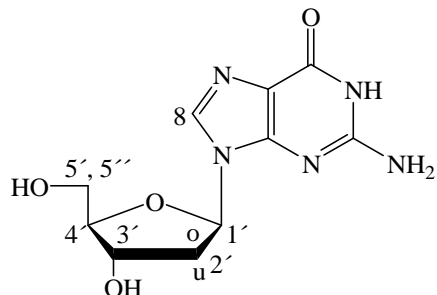
$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.19$$

$$\Delta\delta_{\text{max}} (5'-H, 5''-H) [\text{ppm}] = 0.05, 0.09$$

$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 1.48$$

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

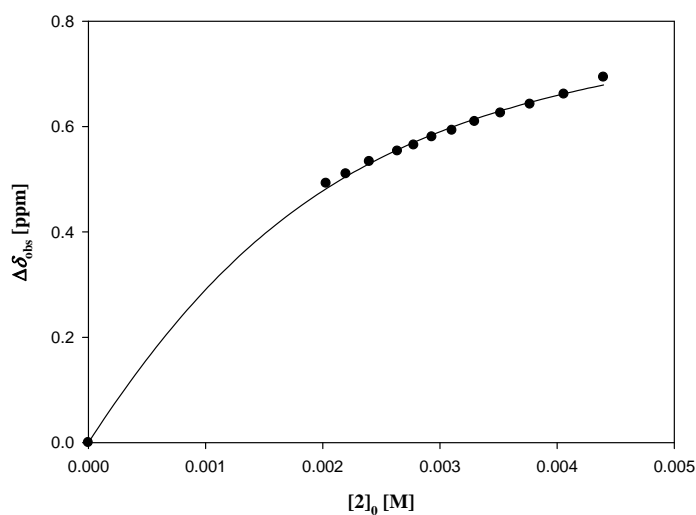
receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	267.10
$T$ [°C]	25	$m_R$ [mg]	1.60
substrate	<b>DG</b>	$m_S$ [mg]	1.30



$\delta_0$ (1'-H) [ppm]	= 6.301
$\delta_0$ (2'-o-H) [ppm]	= 2.504
$\delta_0$ (3'-H) [ppm]	= 4.617
$\delta_0$ (4'-H) [ppm]	= 4.123
$\delta_0$ (5'-H, 5''-H) [ppm]	= 3.752, 3.812
$\delta_0$ (8-H) [ppm]	= 7.979

$V_0$ [mL]	3
$[S]_0$ [mM]	1.52

$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	4.40	5.607	0.693	0.679
0.65	4.10	5.639	0.661	0.662
0.70	3.80	5.658	0.642	0.646
0.75	3.50	5.675	0.626	0.630
0.80	3.30	5.691	0.609	0.614
0.85	3.10	5.708	0.593	0.599
0.90	2.90	5.720	0.580	0.584
0.95	2.80	5.736	0.564	0.570
1.00	2.60	5.747	0.553	0.556
1.10	2.40	5.767	0.533	0.530
1.20	2.20	5.790	0.510	0.505
1.30	2.00	5.808	0.492	0.483



$$K_a [M^{-1}] = 740 \pm 80$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.90$$

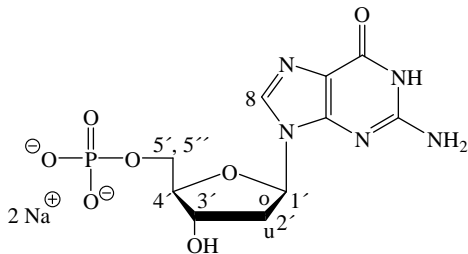
$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.28$$

$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.22$$

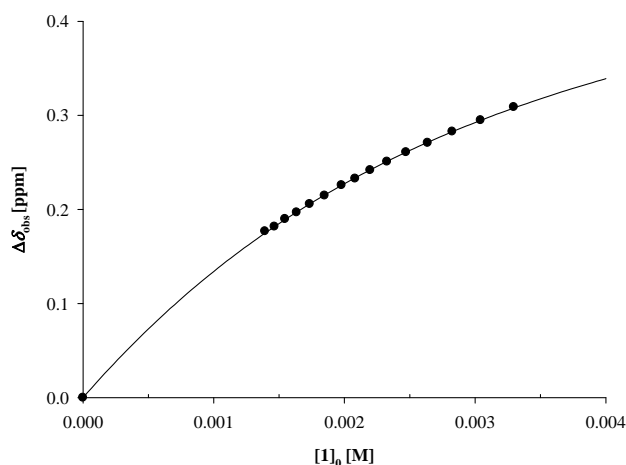
$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 1.27$$

### <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	436.20
$T$ [°C]	25	$m_R$ [mg]	1.23
substrate	<b>DGMP</b>	$m_S$ [mg]	2.13
	$\delta_0$ (1'-H) [ppm] = 6.310	$V_0$ [mL]	3.5
	$\delta_0$ (2'-o-H) [ppm] = 2.490	$[S]_0$ [mM]	1.40
	$\delta_0$ (2'-u-H) [ppm] = 2.783		
	$\delta_0$ (3'-H) [ppm] = 4.692		
	$\delta_0$ (4'-H) [ppm] = 4.204		
	$\delta_0$ (5'-H, 5''-H) [ppm] = 3.937		
	$\delta_0$ (8-H) [ppm] = 8.142		



$V$ [mL]	$[I]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	3.30	6.001	0.309	0.308
0.65	3.04	6.015	0.295	0.295
0.70	2.83	6.027	0.283	0.283
0.75	2.64	6.039	0.271	0.271
0.80	2.47	6.049	0.261	0.261
0.85	2.33	6.059	0.251	0.251
0.90	2.20	6.068	0.242	0.242
0.95	2.08	6.077	0.233	0.234
1.00	1.98	6.084	0.226	0.226
1.07	1.85	6.095	0.215	0.215
1.14	1.74	6.104	0.206	0.206
1.21	1.63	6.113	0.197	0.197
1.28	1.55	6.120	0.190	0.189
1.35	1.47	6.128	0.182	0.182
1.42	1.39	6.133	0.177	0.175



$$K_a [M^{-1}] = 470 \pm 30$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.58$$

$$\Delta\delta_{\text{max}} (2'-o-H) [\text{ppm}] = 0.09$$

$$\Delta\delta_{\text{max}} (2'-u-H) [\text{ppm}] = 0.33$$

$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.08$$

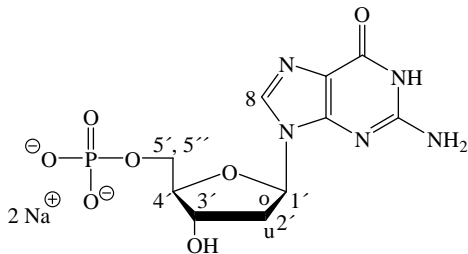
$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.05$$

$$\Delta\delta_{\text{max}} (5'-H, 5''-H) [\text{ppm}] = -0.04$$

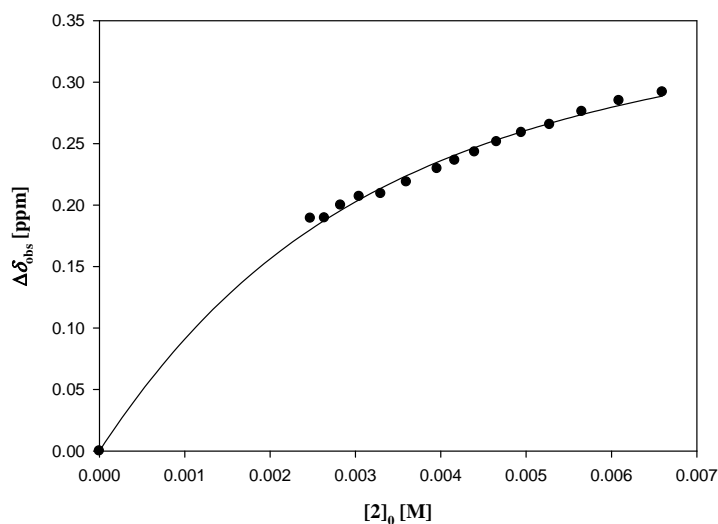
$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 0.50$$

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	436.20
$T$ [°C]	25	$m_R$ [mg]	2.40
substrate	<b>DGMP</b>	$m_S$ [mg]	2.20
	$\delta_0$ (1'-H) [ppm] = 6.310	$V_0$ [mL]	3.0
	$\delta_0$ (2'-o-H) [ppm] = 2.490	$[S]_0$ [mM]	1.68
	$\delta_0$ (2'-u-H) [ppm] = 2.783		
	$\delta_0$ (3'-H) [ppm] = 4.692		
	$\delta_0$ (4'-H) [ppm] = 4.204		
	$\delta_0$ (5'-H, 5''-H) [ppm] = 3.937		
	$\delta_0$ (8-H) [ppm] = 8.142		



$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	6.60	6.018	0.292	0.289
0.65	6.09	6.025	0.285	0.281
0.70	5.65	6.034	0.276	0.274
0.75	5.28	6.044	0.265	0.266
0.80	4.95	6.051	0.259	0.260
0.85	4.66	6.058	0.251	0.247
0.90	4.40	6.067	0.243	0.241
0.95	4.17	6.073	0.236	0.235
1.00	3.96	6.080	0.230	0.224
1.10	3.60	6.091	0.219	0.214
1.20	3.30	6.100	0.209	0.204
1.30	3.04	6.103	0.207	0.196
1.40	2.83	6.110	0.200	0.188
1.50	2.64	6.120	0.190	0.182
1.60	2.47	6.121	0.189	0.180



$$K_a [M^{-1}] = 460 \pm 40$$

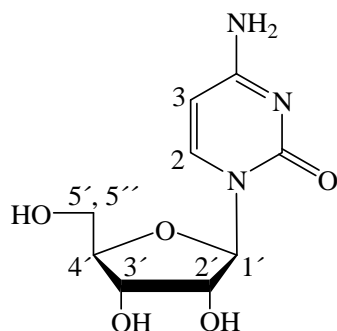
$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.42$$

$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.08$$

$$\Delta\delta_{\text{max}} (8-H) [\text{ppm}] = 0.41$$

# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

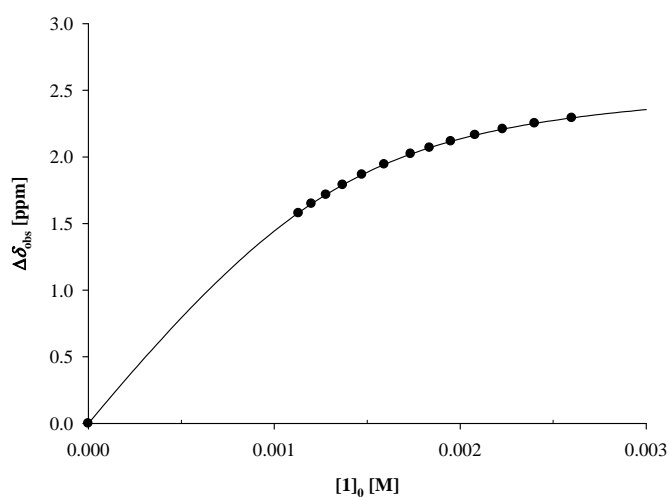
receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	243.22
$T$ [°C]	25	$m_R$ [mg]	0.97
substrate	cytidine (C)	$m_S$ [mg]	0.67



$\delta_0$ (1'-H) [ppm]	= 5.893
$\delta_0$ (2'-H) [ppm]	= 4.296
$\delta_0$ (5'-H, 5''-H) [ppm]	= 3.797, 3.910
$\delta_0$ (2-H) [ppm]	= 7.829
$\delta_0$ (3-H) [ppm]	= 6.044

$V_0$ [mL]	2
$[S]_0$ [mM]	1.36

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	2.60	5.537	2.292	2.293
0.65	2.40	5.577	2.252	2.252
0.70	2.23	5.620	2.209	2.208
0.75	2.08	5.665	2.164	2.163
0.80	1.95	5.712	2.116	2.117
0.85	1.84	5.760	2.069	2.069
0.90	1.73	5.806	2.022	2.021
0.98	1.59	5.884	1.944	1.943
1.06	1.47	5.962	1.867	1.866
1.14	1.37	6.039	1.790	1.790
1.22	1.28	6.112	1.716	1.717
1.30	1.20	6.181	1.648	1.647
1.38	1.13	6.252	1.577	1.580



$$K_a [M^{-1}] = 5240 \pm 420$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.76$$

$$\Delta\delta_{\text{max}} (2'-H) [\text{ppm}] = 0.48$$

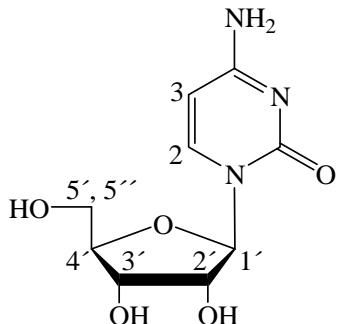
$$\Delta\delta_{\text{max}} (5'-H, 5''-H) [\text{ppm}] = -0.20, -0.21$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 2.63$$

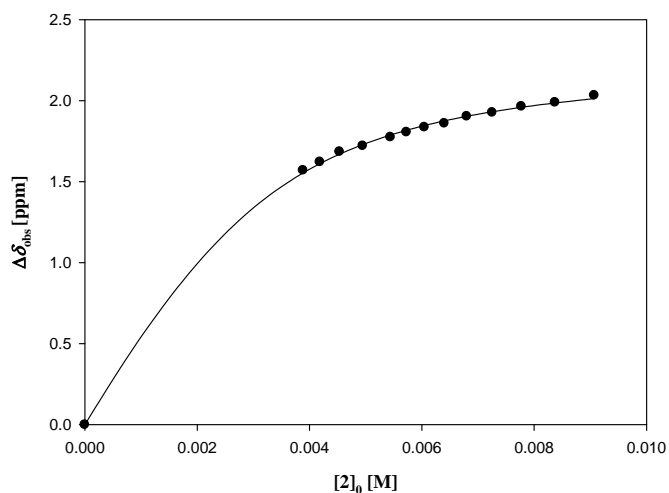
$$\Delta\delta_{\text{max}} (3-H) [\text{ppm}] = 4.73$$

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	243.22
$T$ [°C]	25	$m_R$ [mg]	3.30
substrate	cytidine (C)	$m_S$ [mg]	2.30
	$\delta_0$ (1'-H) [ppm] = 5.893	$V_0$ [mL]	3
	$\delta_0$ (2'-H) [ppm] = 4.296	$[S]_0$ [mM]	3.15
	$\delta_0$ (5'-H, 5''-H) [ppm] = 3.797, 3.910		
	$\delta_0$ (2-H) [ppm] = 7.829		
	$\delta_0$ (3-H) [ppm] = 6.044		



$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	9.07	5.796	2.033	2.012
0.65	8.37	5.840	1.989	1.986
0.70	7.77	5.864	1.964	1.959
0.75	7.26	5.902	1.927	1.932
0.80	6.80	5.926	1.903	1.904
0.85	6.40	5.969	1.860	1.875
0.90	6.05	5.993	1.836	1.846
0.95	5.73	6.023	1.806	1.817
1.00	5.44	6.054	1.775	1.788
1.10	4.95	6.108	1.720	1.729
1.20	4.53	6.144	1.685	1.670
1.30	4.19	6.208	1.621	1.611
1.40	3.89	6.259	1.569	1.554



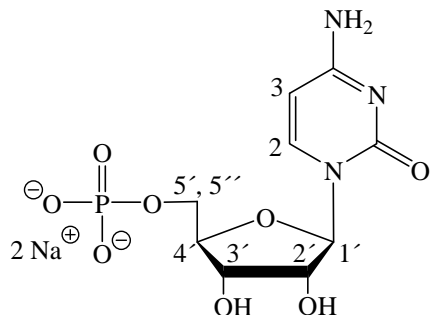
$$K_a [M^{-1}] = 1070 \pm 50$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.75$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 2.39$$

# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

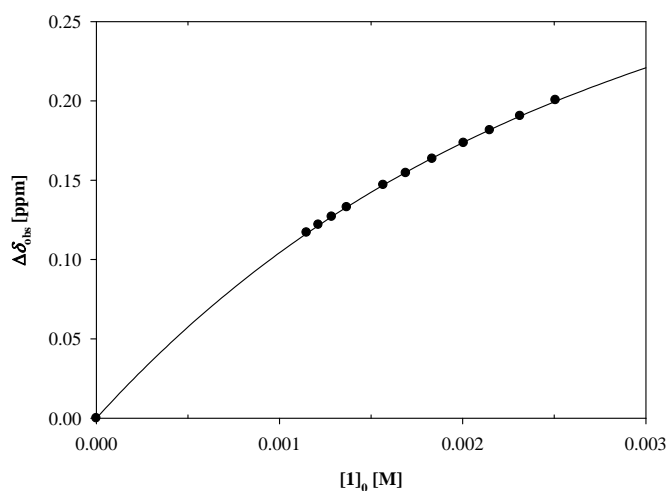
receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	323.05
$T$ [°C]	25	$m_R$ [mg]	0.94
substrate	<b>CMP</b>	$m_S$ [mg]	1.49



$\delta_0$ (1'-H) [ppm]	= 5.994
$\delta_0$ (2'-H) [ppm]	= 4.334
$\delta_0$ (3'-H) [ppm]	= 4.324
$\delta_0$ (4'-H) [ppm]	= 4.233
$\delta_0$ (5'-H, 5''-H) [ppm]	= 3.975, 4.054
$\delta_0$ (2-H) [ppm]	= 8.079
$\delta_0$ (3-H) [ppm]	= 6.122

$V_0$ [mL]	4
$[S]_0$ [mM]	1.10

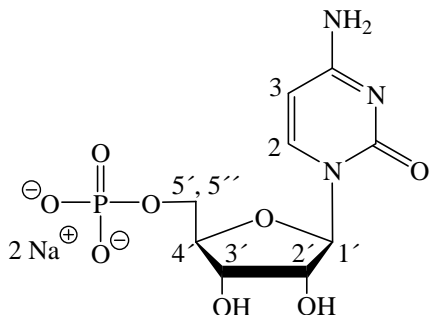
$V$ [mL]	$[1]_0$ [mM]	$\delta_{obs}$ (1'-H)	$\Delta\delta_{obs}$	$\Delta\delta_{calc}$
0.60	2.51	5.793	0.201	0.200
0.65	2.31	5.803	0.190	0.190
0.70	2.15	5.812	0.182	0.182
0.75	2.01	5.820	0.173	0.174
0.82	1.83	5.830	0.163	0.164
0.89	1.69	5.839	0.154	0.155
0.96	1.57	5.847	0.147	0.147
1.10	1.37	5.861	0.133	0.133
1.17	1.29	5.867	0.127	0.127
1.24	1.21	5.872	0.122	0.121
1.31	1.15	5.877	0.117	0.116



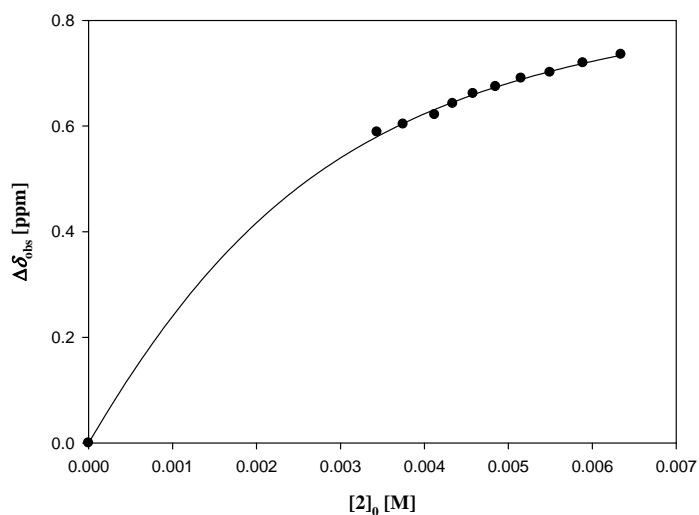
$K_a$ [M <sup>-1</sup> ]	= 440 ± 10
$\Delta\delta_{max}$ (1'-H) [ppm]	= 0.43
$\Delta\delta_{max}$ (2'-H) [ppm]	= 0.14
$\Delta\delta_{max}$ (3'-H) [ppm]	= 0.18
$\Delta\delta_{max}$ (4'-H) [ppm]	= 0.05
$\Delta\delta_{max}$ (5'-H, 5''-H) [ppm]	= -0.14, -0.17
$\Delta\delta_{max}$ (2-H) [ppm]	= 1.74
$\Delta\delta_{max}$ (3-H) [ppm]	= 2.72

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	323.05
$T$ [°C]	25	$m_R$ [mg]	2.50
substrate	<b>CMP</b>	$m_S$ [mg]	2.10
	$\delta_0$ (1'-H) [ppm] = 5.994	$V_0$ [mL]	3
	$\delta_0$ (2'-H) [ppm] = 4.334	$[S]_0$ [mM]	2.16
	$\delta_0$ (3'-H) [ppm] = 4.324		
	$\delta_0$ (4'-H) [ppm] = 4.233		
	$\delta_0$ (5'-H, 5''-H) [ppm] = 3.975, 4.054		
	$\delta_0$ (2-H) [ppm] = 8.079		
	$\delta_0$ (3-H) [ppm] = 6.122		



$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	6.90	-	-	-
0.65	6.30	7.587	0.735	0.727
0.70	5.90	7.603	0.719	0.715
0.75	5.50	7.621	0.701	0.704
0.80	5.20	7.632	0.690	0.692
0.85	4.90	7.648	0.674	0.680
0.90	4.60	7.661	0.651	0.657
0.95	4.30	7.680	0.642	0.645
1.00	4.10	7.701	0.621	0.622
1.10	3.70	7.719	0.603	0.600
1.20	3.40	7.734	0.588	0.579



$$K_a [M^{-1}] = 320 \pm 20$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.20$$

$$\Delta\delta_{\text{max}} (2'-H) [\text{ppm}] = 0.14$$

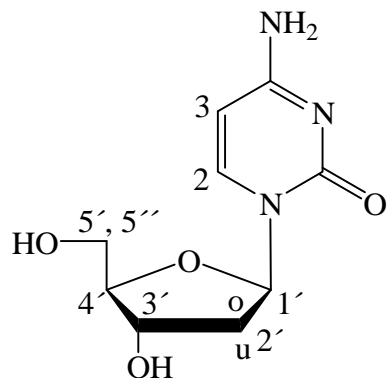
$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.11$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 0.86$$

$$\Delta\delta_{\text{max}} (3-H) [\text{ppm}] = 1.16$$

# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

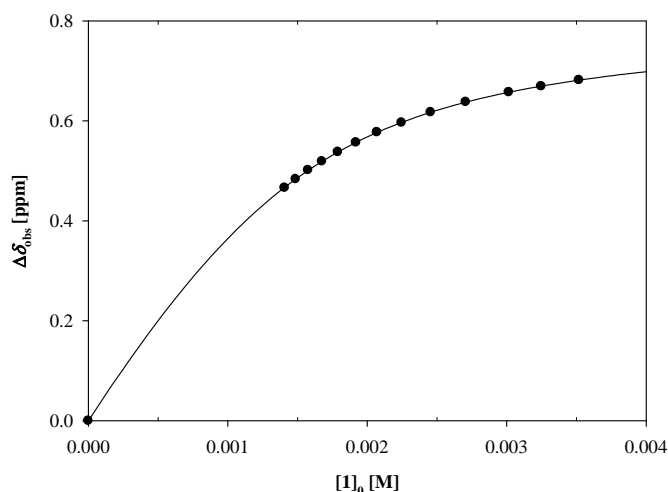
receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	245.10
$T$ [°C]	25	$m_R$ [mg]	1.42
substrate	DC	$m_S$ [mg]	1.84



$\delta_0$ (1'-H) [ppm]	= 6.260
$\delta_0$ (2'-u-H) [ppm]	= 2.415
$\delta_0$ (2'-o-H) [ppm]	= 2.289
$\delta_0$ (3'-H) [ppm]	= 4.421
$\delta_0$ (5'-H v 5''-H) [ppm]	= 3.740
$\delta_0$ (2-H) [ppm]	= 7.815

$V_0$ [mL]	5
$[S]_0$ [mM]	1.49

$V$ [mL]	$[1]_0$ [mM]	$\delta_{obs}$ (1'-H)	$\Delta\delta_{obs}$	$\Delta\delta_{calc}$
0.60	3.52	5.578	0.682	0.682
0.65	3.25	5.591	0.669	0.670
0.70	3.02	5.603	0.658	0.657
0.78	2.71	5.622	0.638	0.637
0.86	2.45	5.643	0.617	0.617
0.94	2.25	5.664	0.596	0.597
1.02	2.07	5.683	0.577	0.577
1.10	1.92	5.703	0.557	0.557
1.18	1.79	5.722	0.538	0.538
1.26	1.68	5.741	0.519	0.519
1.34	1.58	5.759	0.501	0.501
1.42	1.49	5.777	0.483	0.483
1.50	1.41	5.794	0.466	0.467



$$K_a [M^{-1}] = 2640 \pm 40$$

$$\Delta\delta_{max} (1'-H) [ppm] = 0.80$$

$$\Delta\delta_{max} (2'-o-H) [ppm] = 0.49$$

$$\Delta\delta_{max} (2'-u-H) [ppm] = 0.19$$

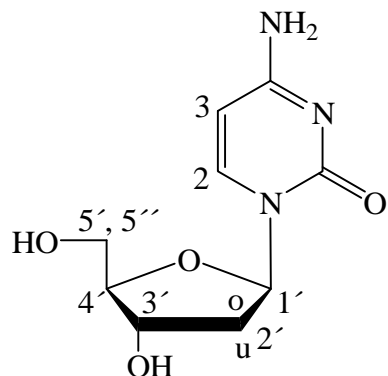
$$\Delta\delta_{max} (3'-H) [ppm] = 0.11$$

$$\Delta\delta_{max} (5'-H \text{ v } 5''-H) [ppm] = -0.18$$

$$\Delta\delta_{max} (2-H) [ppm] = 2.51$$

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

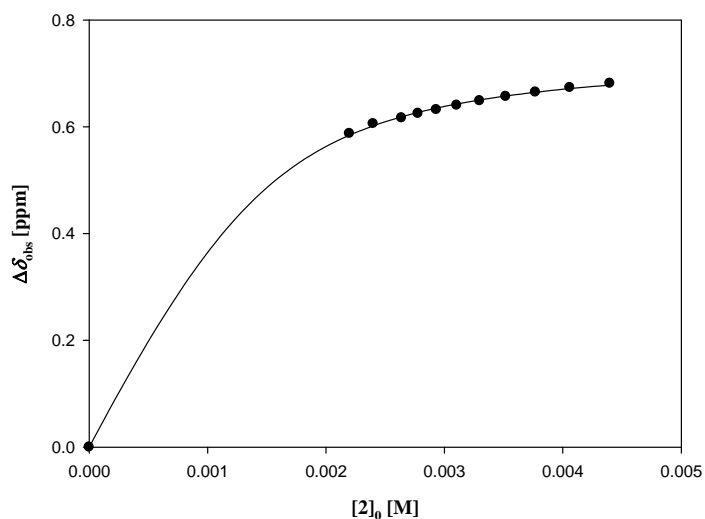
receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	245.10
$T$ [°C]	25	$m_R$ [mg]	1.60
substrate	DC	$m_S$ [mg]	1.10



$\delta_0$ (1'-H) [ppm]	= 6.260
$\delta_0$ (2'-u-H) [ppm]	= 2.415
$\delta_0$ (2'-o-H) [ppm]	= 2.289
$\delta_0$ (3'-H) [ppm]	= 4.421
$\delta_0$ (5'-H v 5''-H) [ppm]	= 3.740
$\delta_0$ (2-H) [ppm]	= 7.815

$V_0$ [mL]	3
$[S]_0$ [mM]	1.49

$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	4.40	5.579	0.681	0.678
0.65	4.10	5.587	0.673	0.671
0.70	3.80	5.595	0.665	0.665
0.75	3.50	5.603	0.657	0.658
0.80	3.30	5.611	0.649	0.650
0.85	3.10	5.620	0.640	0.643
0.90	2.90	5.628	0.632	0.635
0.95	2.80	5.635	0.625	0.627
1.00	2.60	5.644	0.616	0.619
1.10	2.40	5.654	0.606	0.602
1.20	2.20	5.673	0.587	0.584



$$K_a [M^{-1}] = 3000 \pm 190$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.74$$

$$\Delta\delta_{\text{max}} (2'-o-H) [\text{ppm}] = 0.55$$

$$\Delta\delta_{\text{max}} (2'-u-H) [\text{ppm}] = 0.20$$

$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.17$$

$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.08$$

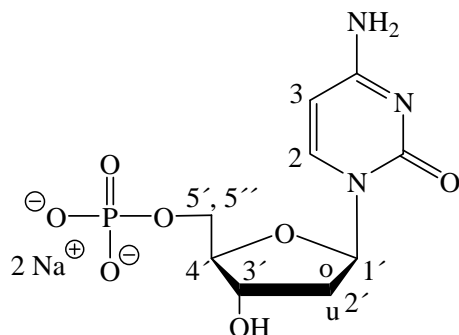
$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 2.33$$

# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor  
solvent  
 $T$  [°C]  
substrate

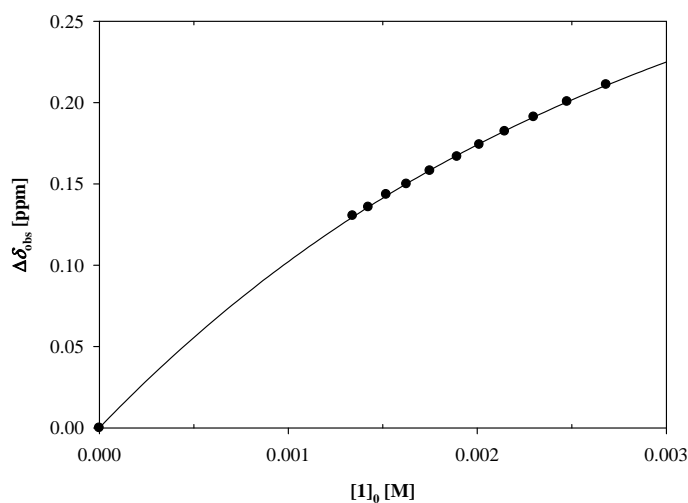
Clip 1  
phosphate buffer

$M_R$  [g/mol] 622.13  
 $M_S$  [g/mol] 291.06  
 $m_R$  [mg] 1.00  
 $m_S$  [mg] 1.67  
 $V_0$  [mL] 4  
 $[S]_0$  [mM] 1.38



**DCMP**  
 $\delta_0$  (1'-H) [ppm] = 6.325  
 $\delta_0$  (2'-u-H) [ppm] = 2.387  
 $\delta_0$  (2'-o-H) [ppm] = 2.311  
 $\delta_0$  (3'-H) [ppm] = 4.548  
 $\delta_0$  (4'-H) [ppm] = 4.151  
 $\delta_0$  (2-H) [ppm] = 8.037  
 $\delta_0$  (3-H) [ppm] = 6.108

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	2.68	6.114	0.211	0.211
0.65	2.48	6.124	0.201	0.200
0.70	2.30	6.133	0.191	0.191
0.75	2.15	6.142	0.182	0.183
0.80	2.01	6.150	0.174	0.175
0.85	1.89	6.158	0.167	0.168
0.92	1.75	6.167	0.158	0.158
0.99	1.63	6.175	0.150	0.150
1.06	1.52	6.181	0.144	0.143
1.13	1.42	6.189	0.136	0.136
1.20	1.34	6.194	0.130	0.130



$K_a$  [ $M^{-1}$ ] =  $430 \pm 20$   
 $\Delta\delta_{\text{max}}$  (1'-H) [ppm] = 0.46  
 $\Delta\delta_{\text{max}}$  (2'-o-H) [ppm] = 0.23  
 $\Delta\delta_{\text{max}}$  (2'-u-H) [ppm] = 0.09  
 $\Delta\delta_{\text{max}}$  (3'-H) [ppm] = 0.08  
 $\Delta\delta_{\text{max}}$  (4'-H) [ppm] = 0.06  
 $\Delta\delta_{\text{max}}$  (2-H) [ppm] = 1.67  
 $\Delta\delta_{\text{max}}$  (3-H) [ppm] = 2.70

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor  
solvent  
 $T$  [°C]  
substrate

Clip 2  
phosphate buffer

25

**DCMP**

$\delta_0$  (1'-H) [ppm] = 6.325

$\delta_0$  (2'-u-H) [ppm] = 2.387

$\delta_0$  (2'-o-H) [ppm] = 2.311

$\delta_0$  (3'-H) [ppm] = 4.548

$\delta_0$  (4'-H) [ppm] = 4.151

$\delta_0$  (2-H) [ppm] = 8.037

$\delta_0$  (3-H) [ppm] = 6.108

$M_R$  [g/mol] 606.41

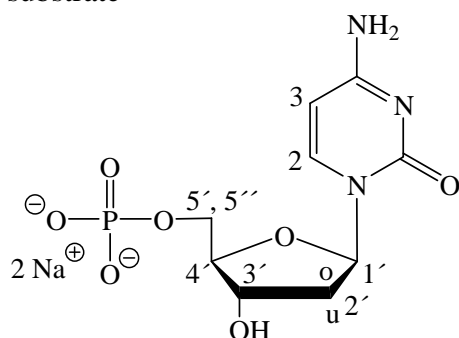
$M_S$  [g/mol] 291.06

$m_R$  [mg] 2.60

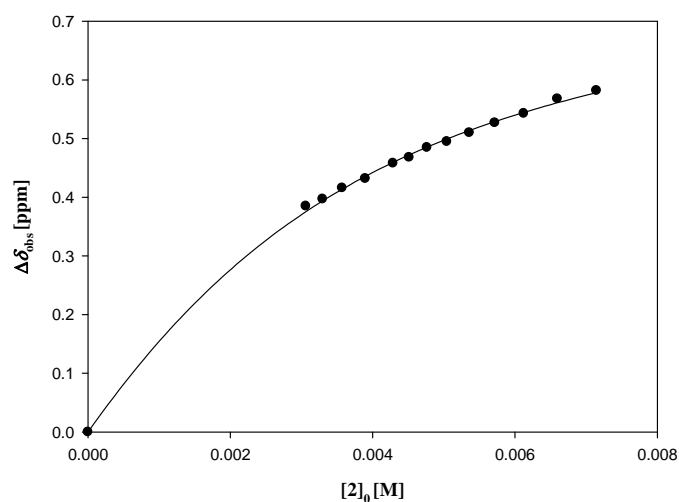
$m_S$  [mg] 2.20

$V_0$  [mL] 3

$[S]_0$  [mM] 2.25



$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	7.10	7.455	0.582	0.578
0.65	6.60	7.469	0.568	0.561
0.70	6.10	7.494	0.543	0.545
0.75	5.70	7.510	0.527	0.529
0.80	5.40	7.527	0.510	0.514
0.85	5.00	7.542	0.495	0.499
0.90	4.80	7.552	0.485	0.485
0.95	4.50	7.569	0.468	0.472
1.00	4.30	7.579	0.458	0.459
1.10	3.90	7.605	0.432	0.436
1.20	3.60	7.621	0.416	0.414
1.30	3.30	7.640	0.397	0.394
1.40	3.10	7.652	0.385	0.376



$$K_a [M^{-1}] = 370 \pm 20$$

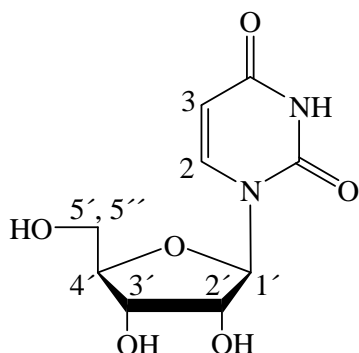
$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.26$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 0.84$$

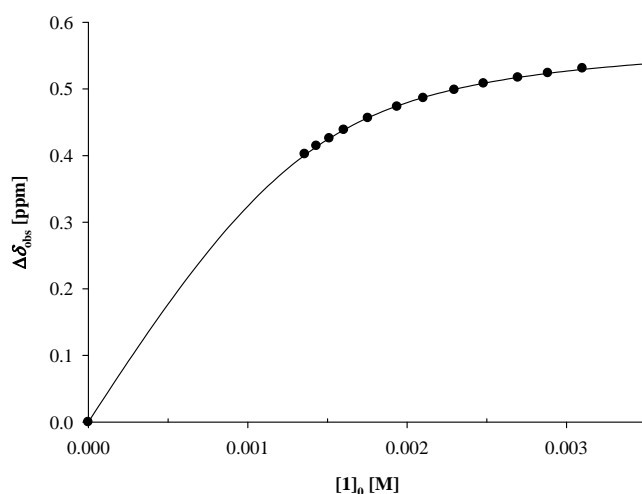
$$\Delta\delta_{\text{max}} (3-H) [\text{ppm}] = 1.32$$

# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	244.07
$T$ [°C]	25	$m_R$ [mg]	1.16
substrate	uridine (U)	$m_S$ [mg]	1.36
	$\delta_0$ (1'-H) [ppm] = 5.903	$V_0$ [mL]	4
	$\delta_0$ (2'-H) [ppm] = 4.341	$[S]_0$ [mM]	1.38
	$\delta_0$ (3'-H) [ppm] = 4.215		
	$\delta_0$ (5'-H v 5''-H) [ppm] = 3.895		
	$\delta_0$ (2-H) [ppm] = 7.861		
	$\delta_0$ (3-H) [ppm] = 5.886		



$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	3.10	5.372	0.531	0.529
0.65	2.88	5.379	0.524	0.523
0.69	2.70	5.386	0.517	0.517
0.75	2.48	5.395	0.508	0.509
0.81	2.30	5.405	0.499	0.499
0.89	2.10	5.417	0.486	0.487
0.96	1.94	5.430	0.473	0.474
1.06	1.76	5.447	0.456	0.457
1.16	1.60	5.465	0.438	0.439
1.23	1.51	5.477	0.426	0.426
1.30	1.43	5.489	0.414	0.413
1.37	1.36	5.501	0.402	0.401



$$K_a [M^{-1}] = 5390 \pm 200$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.58$$

$$\Delta\delta_{\text{max}} (2'-H) [\text{ppm}] = 0.18$$

$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = -0.04$$

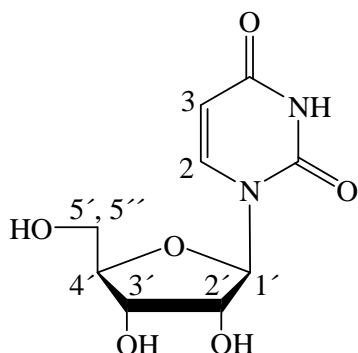
$$\Delta\delta_{\text{max}} (5'-H \text{ v } 5''-H) [\text{ppm}] = -0.25$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 2.74$$

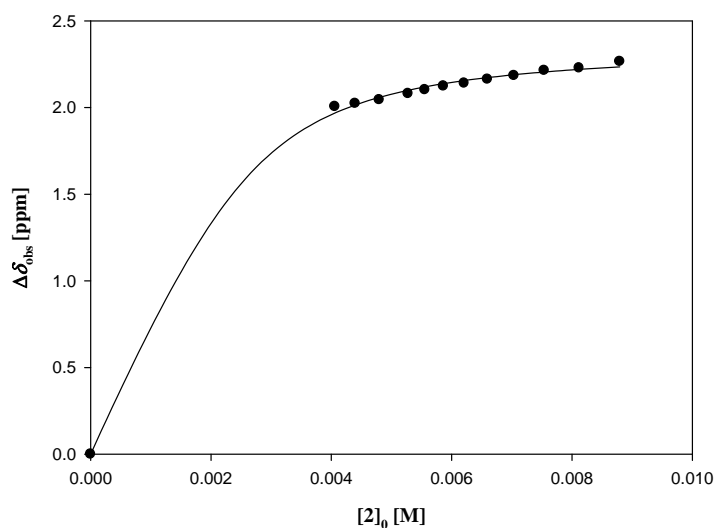
$$\Delta\delta_{\text{max}} (3-H) [\text{ppm}] = 4.80$$

## <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	244.07
$T$ [°C]	25	$m_R$ [mg]	3.20
substrate	uridine (U)	$m_S$ [mg]	2.00
	$\delta_0$ (1'-H) [ppm] = 5.903	$V_0$ [mL]	3
	$\delta_0$ (2'-H) [ppm] = 4.341	$[S]_0$ [mM]	2.73
	$\delta_0$ (3'-H) [ppm] = 4.215		
	$\delta_0$ (5'-H v 5''-H) [ppm] = 3.895		
	$\delta_0$ (2-H) [ppm] = 7.861		
	$\delta_0$ (3-H) [ppm] = 5.886		



$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	8.790	5.596	2.265	2.235
0.65	8.12	5.633	2.228	2.220
0.70	7.54	5.648	2.214	2.205
0.75	7.04	5.677	2.184	2.189
0.80	6.60	5.698	2.163	2.173
0.85	6.21	5.721	2.140	2.155
0.90	5.86	5.738	2.123	2.137
0.95	5.55	5.759	2.102	2.119
1.00	5.28	5.781	2.080	2.099
1.10	4.80	5.817	2.044	2.058
1.20	4.40	5.838	2.023	2.014
1.30	4.06	5.856	2.005	2.968



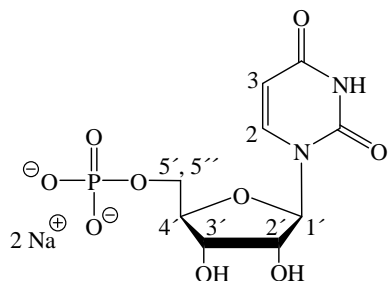
$$K_a [M^{-1}] = 2490 \pm 240$$

$$\Delta\delta_{\text{max}} (1'-\text{H}) [\text{ppm}] = 0.59$$

$$\Delta\delta_{\text{max}} (2-\text{H}) [\text{ppm}] = 2.36$$

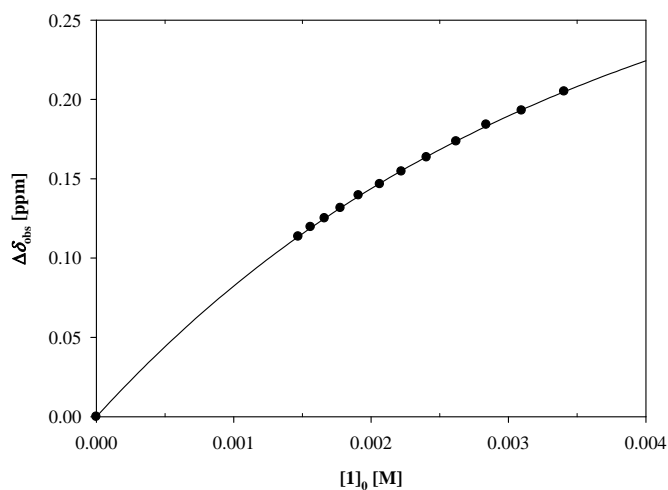
### <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	368.00
$T$ [°C]	25	$m_R$ [mg]	1.27
substrate	UMP	$m_S$ [mg]	2.45
		$V_0$ [mL]	4
		$[S]_0$ [mM]	1.65



$\delta_0$ (1'-H) [ppm]	= 5.986
$\delta_0$ (2'-H) [ppm]	= 4.407
$\delta_0$ (3'-H) [ppm]	= 4.351
$\delta_0$ (4'-H) [ppm]	= 4.248
$\delta_0$ (5'-H, 5''-H) [ppm]	= 3.965, 4.025
$\delta_0$ (2-H) [ppm]	= 8.095

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	3.41	5.781	0.205	0.205
0.66	3.10	5.793	0.193	0.193
0.72	2.84	5.802	0.184	0.183
0.78	2.62	5.812	0.174	0.174
0.85	2.40	5.822	0.164	0.164
0.92	2.22	5.831	0.155	0.155
0.99	2.06	5.839	0.147	0.147
1.07	1.91	5.846	0.140	0.139
1.15	1.78	5.854	0.132	0.132
1.23	1.66	5.861	0.125	0.125
1.31	1.56	5.866	0.120	0.119
1.39	1.47	5.872	0.114	0.114



$$K_a [M^{-1}] = 340 \pm 20$$

$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 0.43$$

$$\Delta\delta_{\text{max}} (2'-H) [\text{ppm}] = 0.10$$

$$\Delta\delta_{\text{max}} (3'-H) [\text{ppm}] = 0.05$$

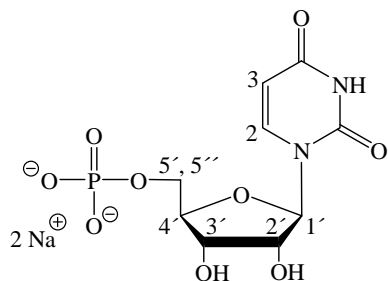
$$\Delta\delta_{\text{max}} (4'-H) [\text{ppm}] = 0.05$$

$$\Delta\delta_{\text{max}} (5'-H, 5''-H) [\text{ppm}] = -0.20, -0.23$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 2.01$$

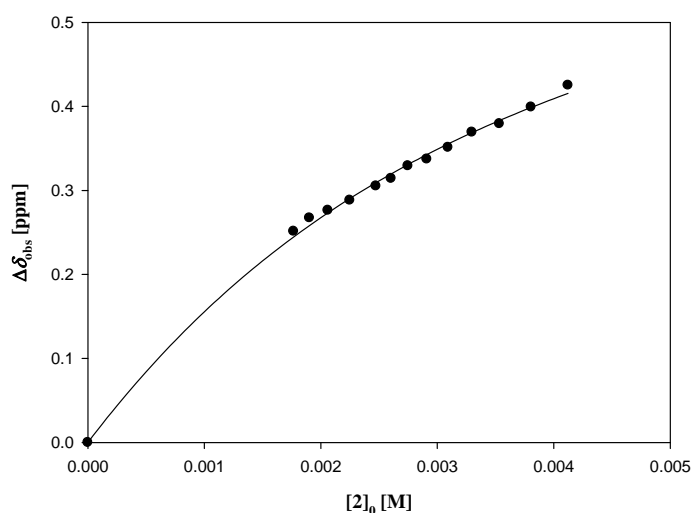
### <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	368.00
$T$ [°C]	25	$m_R$ [mg]	1.50
substrate	UMP	$m_S$ [mg]	1.60
		$V_0$ [mL]	3
		$[S]_0$ [mM]	1.45



$\delta_0$ (1'-H) [ppm]	= 5.986
$\delta_0$ (2'-H) [ppm]	= 4.407
$\delta_0$ (3'-H) [ppm]	= 4.351
$\delta_0$ (4'-H) [ppm]	= 4.248
$\delta_0$ (5'-H, 5''-H) [ppm]	= 3.965, 4.025
$\delta_0$ (2-H) [ppm]	= 8.095

$V$ [mL]	$[2]_0$ [mM]	$\delta_{\text{obs}}$ (2-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	4.10	7.660	0.435	0.425
0.65	3.80	7.686	0.409	0.409
0.70	3.50	7.706	0.389	0.393
0.75	3.30	7.716	0.379	0.379
0.80	3.10	7.734	0.361	0.365
0.85	2.90	7.748	0.347	0.353
0.90	2.70	7.756	0.339	0.341
0.95	2.60	7.771	0.324	0.330
1.00	2.50	7.780	0.315	0.320
1.10	2.20	7.797	0.298	0.300
1.20	2.10	7.809	0.286	0.283
1.30	1.90	7.818	0.277	0.268
1.40	1.80	7.834	0.261	0.254



$$K_a [M^{-1}] = 460 \pm 50$$

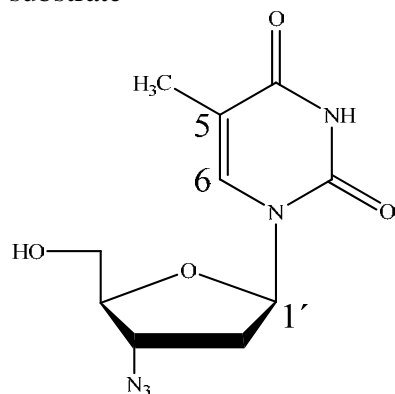
$$\Delta\delta_{\text{max}} (1'-H) [\text{ppm}] = 1.03$$

$$\Delta\delta_{\text{max}} (2-H) [\text{ppm}] = 0.73$$

$$\Delta\delta_{\text{max}} (3-H) [\text{ppm}] = 0.19$$

### <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	267.25
$T$ [°C]	25	$m_R$ [mg]	4.10
substrate	<b>AZT</b>	$m_S$ [mg]	2.70



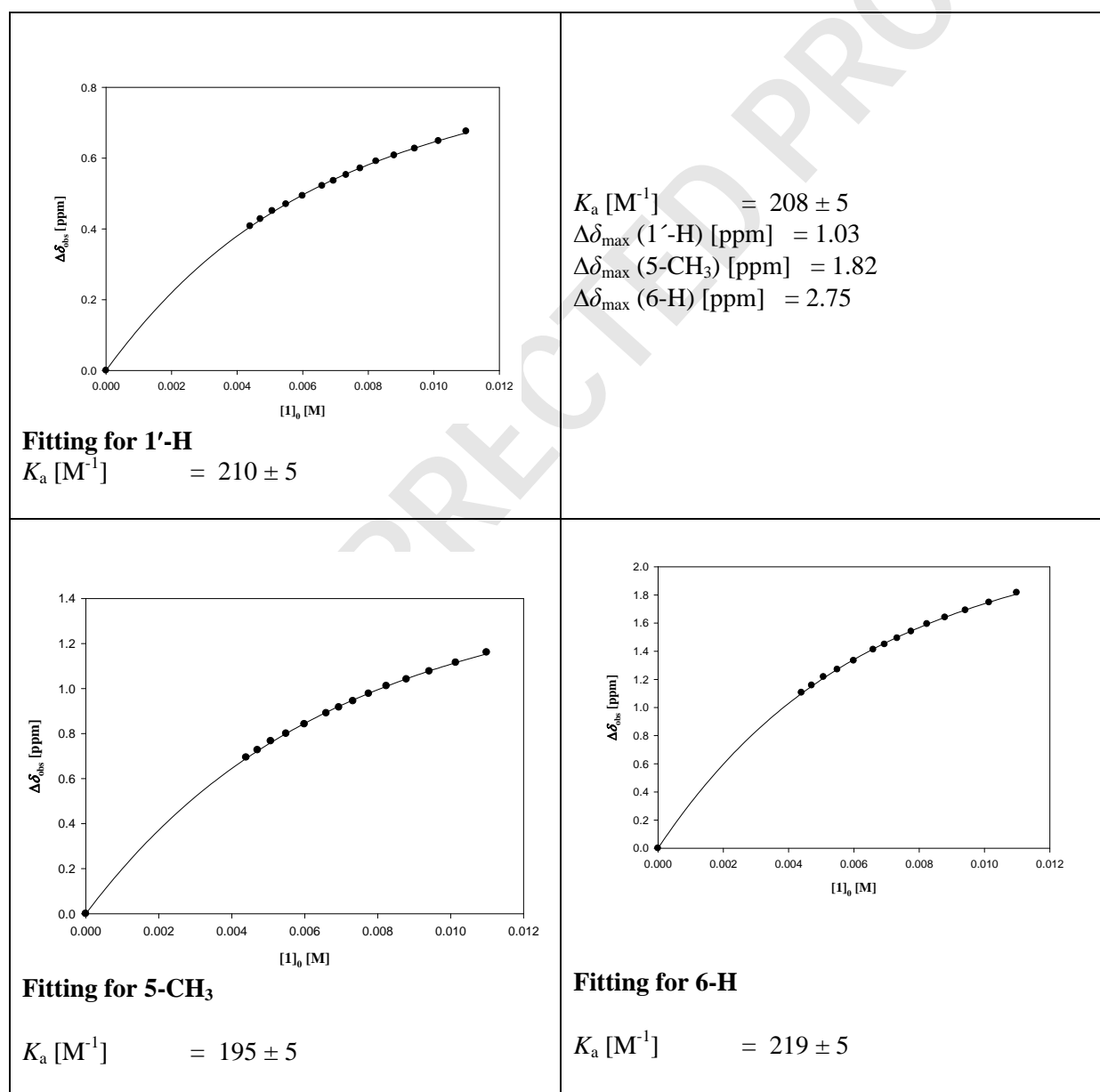
$\delta_0$  (1'-H) [ppm] = 6.217  
 $\delta_0$  (5-CH<sub>3</sub>) [ppm] = 1.887  
 $\delta_0$  (6-H) [ppm] = 7.638

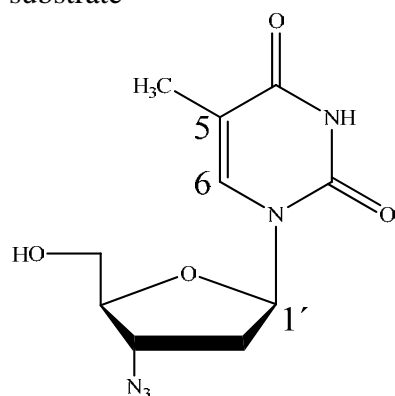
$V_0$  [mL] 3  
 $[S]_0$  [mM] 3.37

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	10.99	5.541	0.676	0.671
0.65	10.14	5.568	0.649	0.649
0.70	9.42	5.589	0.627	0.628
0.75	9.01	5.609	0.608	0.609
0.80	8.79	5.625	0.591	0.590
0.85	8.24	5.645	0.571	0.572
0.90	7.32	5.664	0.553	0.555
0.95	6.94	5.681	0.536	0.539
1.00	6.59	5.695	0.522	0.524
1.10	5.99	5.723	0.494	0.496
1.20	5.49	5.747	0.470	0.470
1.30	5.07	5.766	0.451	0.447
1.40	4.71	5.789	0.428	0.425
1.50	4.39	5.809	0.408	0.406

$V$ [mL]	$[1]_0$ [mM]	$\delta_{\text{obs}}$ (5-CH <sub>3</sub> )	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	10.99	0.726	1.161	1.154
0.65	10.14	0.772	1.115	1.115
0.70	9.42	0.810	1.077	1.078
0.75	9.01	0.846	1.042	1.043
0.80	8.79	0.876	1.012	1.010
0.85	8.24	0.910	0.977	0.979
0.90	7.32	0.943	0.945	0.949
0.95	6.94	0.971	0.917	0.921
1.00	6.59	0.997	0.891	0.894
1.10	5.99	1.046	0.842	0.845
1.20	5.49	1.087	0.800	0.801
1.30	5.07	1.121	0.767	0.760
1.40	4.71	1.161	0.727	0.723
1.50	4.39	1.193	0.694	0.690

V [mL]	[1] <sub>0</sub> [mM]	δ <sub>obs</sub> (6-H)	Δδ <sub>obs</sub>	Δδ <sub>calc</sub>
0.60	10.99	5.821	1.817	1.807
0.65	10.14	5.891	1.747	1.749
0.70	9.42	5.947	1.691	1.694
0.75	9.01	5.997	1.641	1.641
0.80	8.79	6.044	1.594	1.591
0.85	8.24	6.097	1.541	1.544
0.90	7.32	6.145	1.493	1.499
0.95	6.94	6.189	1.449	1.456
1.00	6.59	6.226	1.412	1.416
1.10	5.99	6.305	1.333	1.340
1.20	5.49	6.567	1.271	1.271
1.30	5.07	6.420	1.218	1.209
1.40	4.71	6.481	1.157	1.152
1.50	4.39	6.532	1.106	1.099

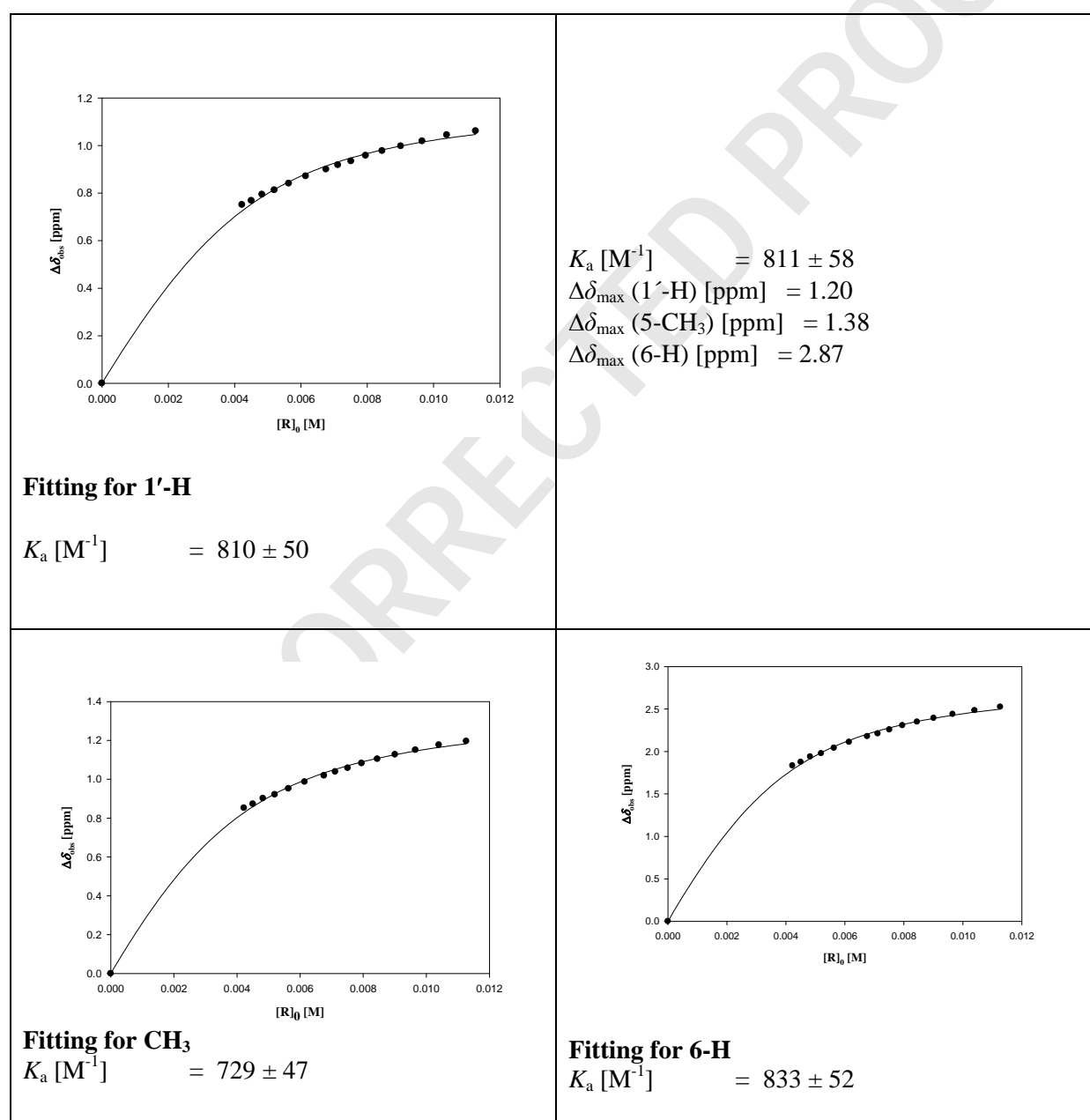


**<sup>1</sup>H-NMR titration experiments with phosphonate clip 2:**receptor  
solvent  
*T* [°C]  
substrateClip 2  
phosphate buffer  
25  
**AZT**  
 $\delta_0$  (1'-H) [ppm] = 6.2166  
 $\delta_0$  (5-CH<sub>3</sub>) [ppm] = 1.8875  
 $\delta_0$  (6-H) [ppm] = 7.6381 $M_R$  [g/mol] 606.41  
 $M_S$  [g/mol] 267.25  
 $m_R$  [mg] 4.10  
 $m_S$  [mg] 2.90  
 $V_0$  [mL] 3  
 $[S]_0$  [mM] 3.62

<i>V</i> [mL]	[2] <sub>0</sub> [mM]	$\delta_{\text{obs}}$ (1'-H)	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	11.27	5.156	1.060	1.046
0.65	10.40	5.173	1.044	1.030
0.70	9.66	5.199	1.018	1.014
0.75	9.01	5.220	0.997	0.998
0.80	8.45	5.240	0.977	0.981
0.85	7.95	5.259	0.957	0.965
0.90	7.51	5.283	0.934	0.948
0.95	7.12	5.299	0.918	0.931
1.00	6.76	5.317	0.899	0.914
1.10	6.15	5.345	0.871	0.880
1.20	5.63	5.377	0.840	0.847
1.30	5.20	5.405	0.812	0.815
1.40	4.83	5.423	0.794	0.784
1.50	4.51	5.449	0.768	0.754
1.60	4.23	5.466	0.750	0.725

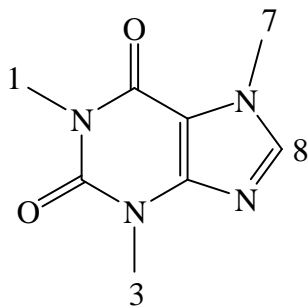
<i>V</i> [mL]	[2] <sub>0</sub> [mM]	$\delta_{\text{obs}}$ (5-CH <sub>3</sub> )	$\Delta\delta_{\text{obs}}$	$\Delta\delta_{\text{calc}}$
0.60	11.27	0.692	1.196	1.183
0.65	10.40	0.711	1.176	1.165
0.70	9.66	0.737	1.150	1.145
0.75	9.01	0.761	1.127	1.127
0.80	8.45	0.783	1.104	1.108
0.85	7.95	0.806	1.082	1.089
0.90	7.51	0.830	1.058	1.070
0.95	7.12	0.849	1.038	1.051
1.00	6.76	0.869	1.019	1.032
1.10	6.15	0.901	0.986	0.996
1.20	5.63	0.936	0.951	0.960
1.30	5.20	0.967	0.920	0.925
1.40	4.83	0.986	0.901	0.891
1.50	4.51	1.016	0.872	0.859
1.60	4.23	1.036	0.852	0.829

V [mL]	[2] <sub>0</sub> [mM]	δ <sub>obs</sub> (6-H)	Δδ <sub>obs</sub>	Δδ <sub>calc</sub>
0.60	11.27	5.114	2.524	1.786
0.65	10.40	5.155	2.483	1.850
0.70	9.66	5.199	2.439	1.917
0.75	9.01	5.246	2.392	1.986
0.80	8.45	5.290	2.348	2.058
0.85	7.95	5.332	2.306	2.130
0.90	7.51	5.382	2.256	2.204
0.95	7.12	5.428	2.210	2.242
1.00	6.76	5.460	2.178	2.279
1.10	6.15	5.528	2.110	2.316
1.20	5.63	5.597	2.041	2.353
1.30	5.20	5.661	1.977	2.390
1.40	4.83	5.701	1.937	2.427
1.50	4.51	5.764	1.874	2.463
1.60	4.23	5.805	1.833	2.498

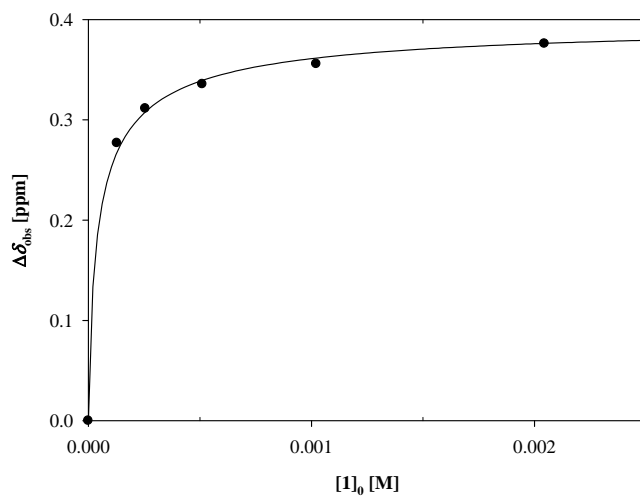


# <sup>1</sup>H-NMR titration experiments with phosphate clip 1:

receptor	Clip 1	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	194.08
$T$ [°C]	25	$m_R$ [mg]	4.24
substrate	caffeine (CAF)	$m_S$ [mg]	1.19
	$\delta_0$ (1-H) [ppm] = 3.526	$V_0$ [mL]	2
	$\delta_0$ (3-H) [ppm] = 3.344	$[R]_0$ [mM]	4.08
	$\delta_0$ (7-H) [ppm] = 3.946	$[S]_0$ [mM]	3.06



$[I]_0$ [mM]	$[CAF]_0$ [mM]	$\delta_{obs}$ (1-H)	$\Delta\delta_{obs}$	$\Delta\delta_{calc}$
2.04	1.53	3.150	0.376	0.376
1.02	0.77	3.170	0.356	0.362
0.51	0.38	3.190	0.336	0.339
0.26	0.19	3.215	0.311	0.308
0.13	0.10	3.249	0.277	0.267



$$K_a [M^{-1}] = 31400 \pm 2300$$

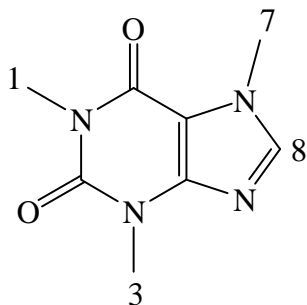
$$\Delta\delta_{max} (1-H) [\text{ppm}] = 0.40$$

$$\Delta\delta_{max} (3-H) [\text{ppm}] = 0.17$$

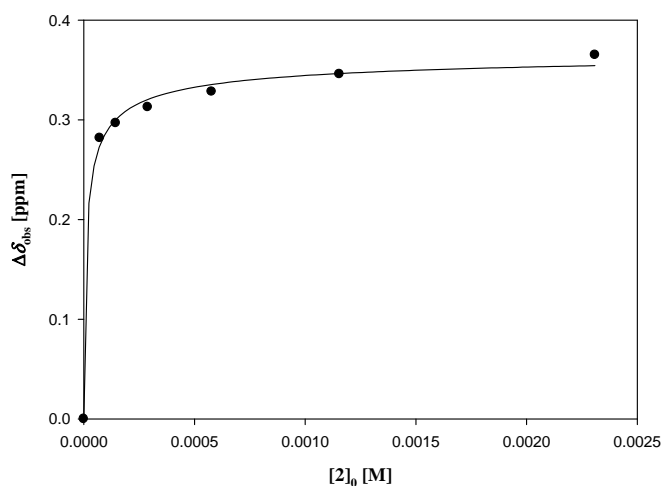
$$\Delta\delta_{max} (7-H) [\text{ppm}] = 0.94$$

### <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor	<b>Clip 2</b>	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	194.08
$T$ [°C]	25	$m_R$ [mg]	4.20
substrate	caffeine ( <b>CAF</b> )	$m_S$ [mg]	1.30
	$\delta_0$ (1-H) [ppm] = 3.526	$V_0$ [mL]	3
	$\delta_0$ (3-H) [ppm] = 3.344	$[R]_0$ [mM]	2.31
	$\delta_0$ (7-H) [ppm] = 3.946	$[S]_0$ [mM]	2.23



$[2]_0$ [mM]	$[CAF]_0$ [mM]	$\delta_{obs}$ (1-H)	$\Delta\delta_{obs}$	$\Delta\delta_{calc}$
2.31	2.23	3.161	0.365	0.354
1.15	1.11	3.180	0.346	0.346
0.58	0.56	3.198	0.328	0.335
0.29	0.28	3.213	0.313	0.320
0.14	0.14	3.229	0.297	0.300
0.07	0.07	3.244	0.282	0.274



$$K_a [M^{-1}] = 9550 \pm 1170$$

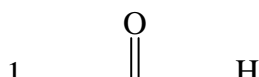
$$\Delta\delta_{max} \text{ (1-H) [ppm]} = 0.71$$

$$\Delta\delta_{max} \text{ (3-H) [ppm]} = 0.25$$

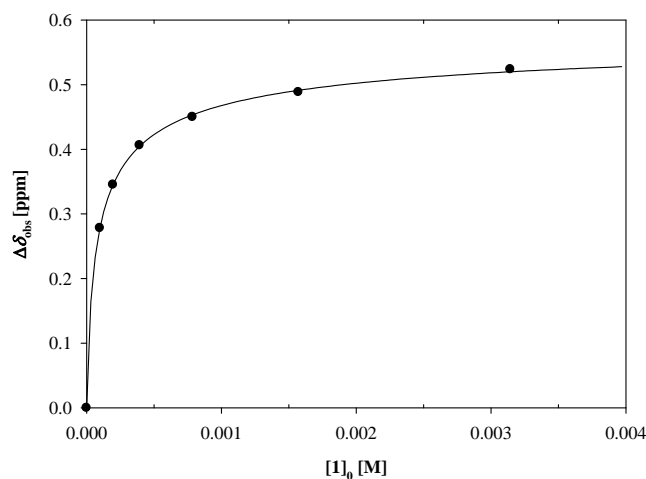
$$\Delta\delta_{max} \text{ (7-H) [ppm]} = 1.02$$

### <sup>1</sup>H-NMR titration experiments with phosphonate clip 1:

receptor	<b>Clip 1</b>	$M_R$ [g/mol]	622.13
solvent	phosphate buffer	$M_S$ [g/mol]	179.06
$T$ [°C]	25	$m_R$ [mg]	3.91
substrate	theophylline ( <b>THE</b> )	$m_S$ [mg]	1.06
	$\delta_0$ (1-H) [ppm] = 3.273	$V_0$ [mL]	2
	$\delta_0$ (3-H) [ppm] = 3.459	$[R]_0$ [mM]	3.14



[1] <sub>0</sub> [mM]	[THE] <sub>0</sub> [mM]	δ <sub>obs</sub> (3-H)	Δδ <sub>obs</sub>	Δδ <sub>calc</sub>
3.14	2.96	2.936	0.524	0.520
1.57	1.48	2.971	0.489	0.491
0.79	0.74	3.009	0.450	0.453
0.39	0.37	3.053	0.406	0.405
0.20	0.18	3.114	0.345	0.345
0.10	0.09	3.181	0.278	0.278



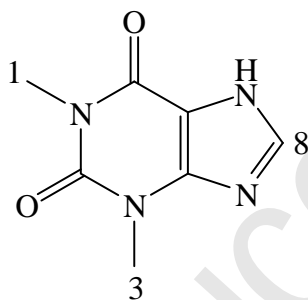
$$K_a [M^{-1}] = 16800 \pm 1260$$

$$\Delta\delta_{\max} (1\text{-H}) [\text{ppm}] = 0.17$$

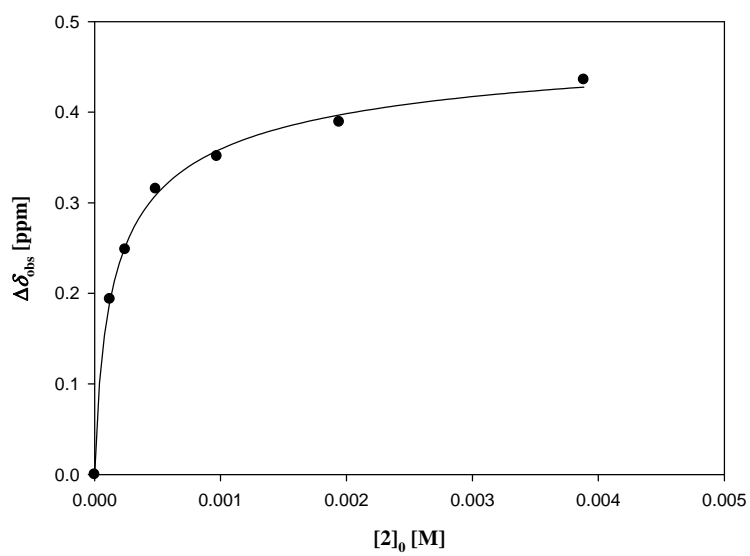
$$\Delta\delta_{\max} (3\text{-H}) [\text{ppm}] = 0.58$$

### <sup>1</sup>H-NMR titration experiments with phosphonate clip 2:

receptor	Clip 2	$M_R$ [g/mol]	606.41
solvent	phosphate buffer	$M_S$ [g/mol]	179.06
$T$ [°C]	25	$m_R$ [mg]	4.60
substrate	theophylline (THE)	$m_S$ [mg]	1.40
	δ <sub>0</sub> (1-H) [ppm] = 3.273	$V_0$ [mL]	2
	δ <sub>0</sub> (3-H) [ppm] = 3.459	[R] <sub>0</sub> [mM]	3.79
		[S] <sub>0</sub> [mM]	3.88



[2] <sub>0</sub> [mM]	[THE] <sub>0</sub> [mM]	δ <sub>obs</sub> (3-H)	Δδ <sub>obs</sub>	Δδ <sub>calc</sub>
3.79	3.88	3.024	0.436	0.428
1.90	1.94	3.070	0.389	0.397
0.95	0.97	3.108	0.351	0.357
0.47	0.49	3.144	0.315	0.308
0.24	0.24	3.211	0.248	0.252
0.12	0.12	3.266	0.193	0.191



$$K_a [\text{M}^{-1}] = 8700 \pm 640$$

$$\Delta\delta_{\text{max}} (1\text{-H}) [\text{ppm}] = 0.17$$

$$\Delta\delta_{\text{max}} (3\text{-H}) [\text{ppm}] = 0.50$$

UNCORRECTED PROOF