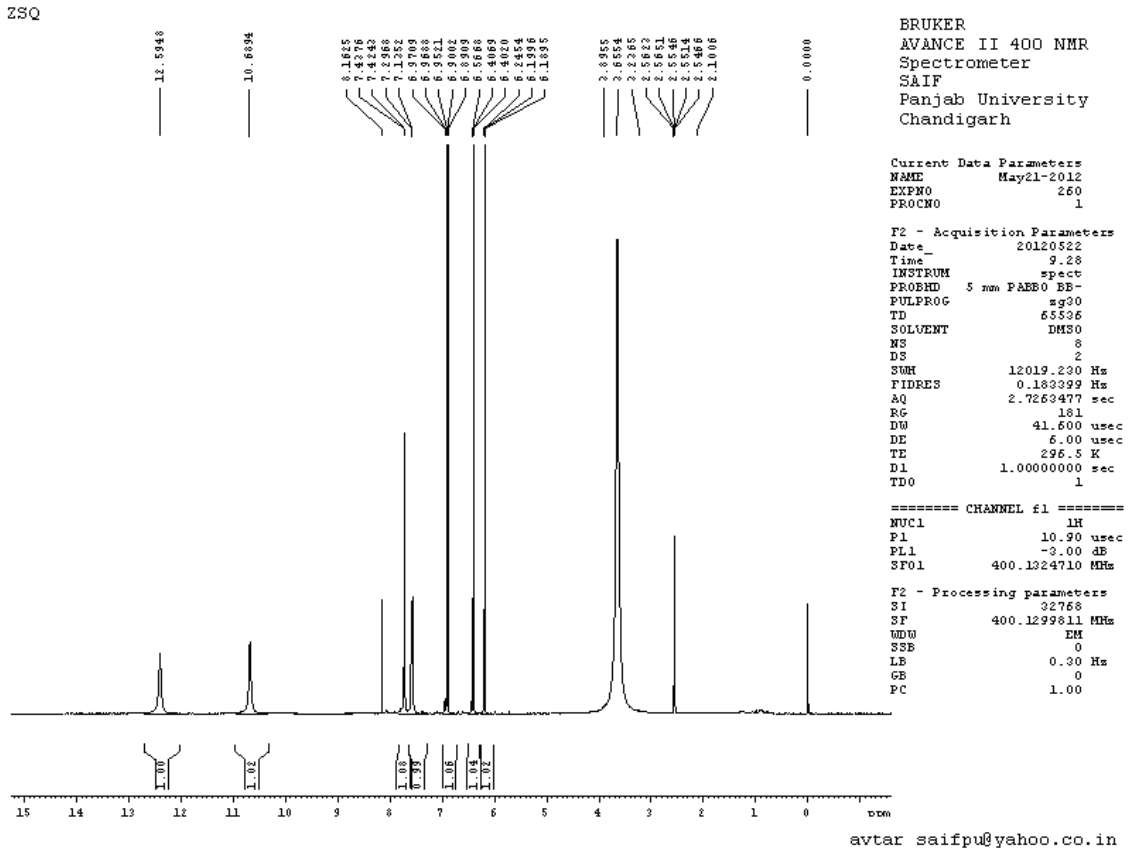
Supplementary data

New modulated design and synthesis of quercetin–Cu^{II}/Zn^{II}–Sn_2^{IV} scaffold as anticancer agents: *in vitro* DNA binding profile, DNA cleavage pathway and Topo–I activity

Sartaj Tabassum,* Mehvash Zaki, Mohd. Afzal, Farukh Arjmand

**Department of Chemistry, Aligarh Muslim University, Aligarh, UP–202202, India. Tel.:* +91 9358255791: *E-mail address:* tsartaj62@yahoo.com



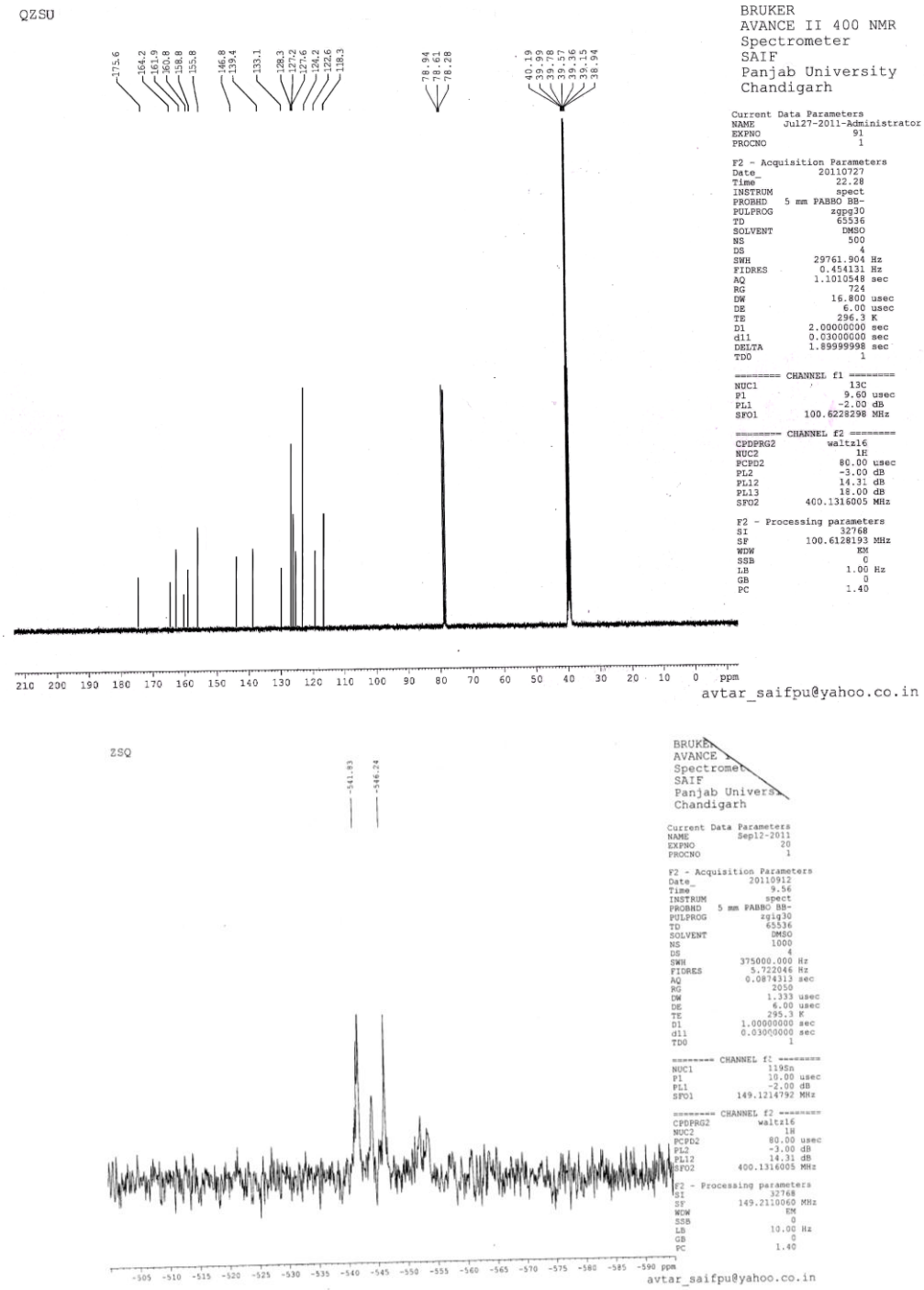
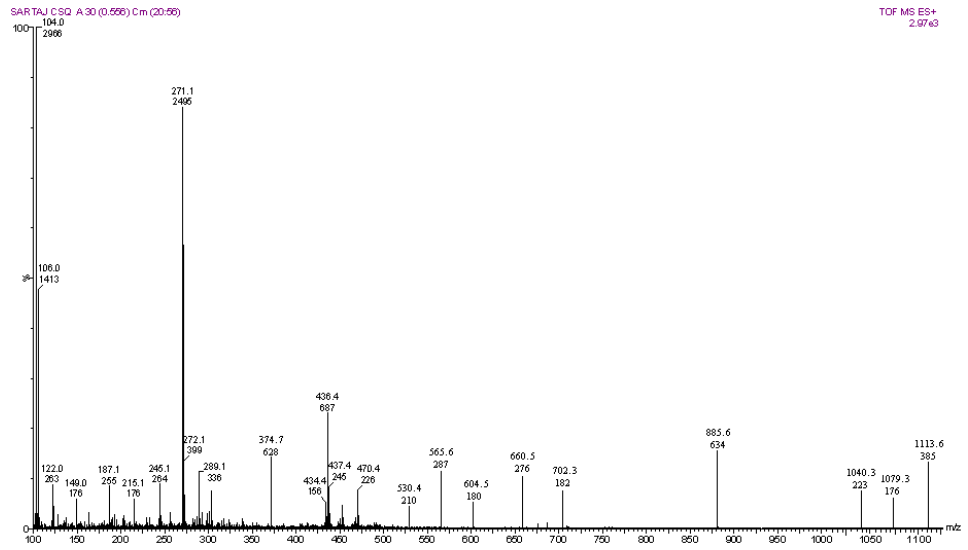


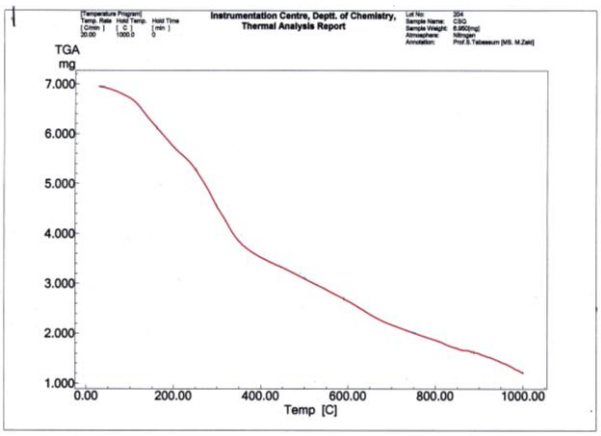
Fig. S1. ^{1}H, ^{13}C and ^{119}Sn NMR spectra of heterobimetallic complex **2**



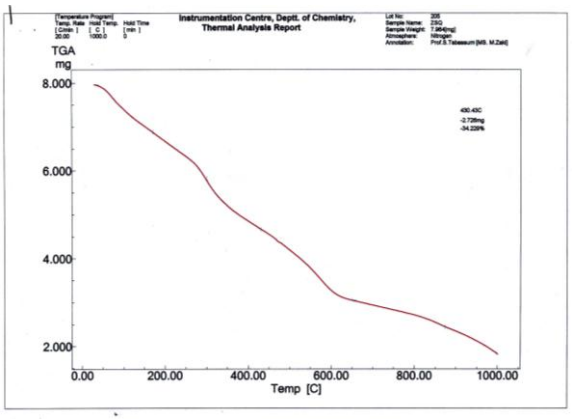
(a)

(b)

Fig. S2. Electrospray ionization (ESI) mass spectrum of (a) complex **1** and (b) complex **2**.



(a)



(b)

Fig. S3. TGA profiles of complexes (a) complex **1** and (b) complex **2**

Fig. S4. X–band EPR spectrum of complex **1** at LNT in liquid state.

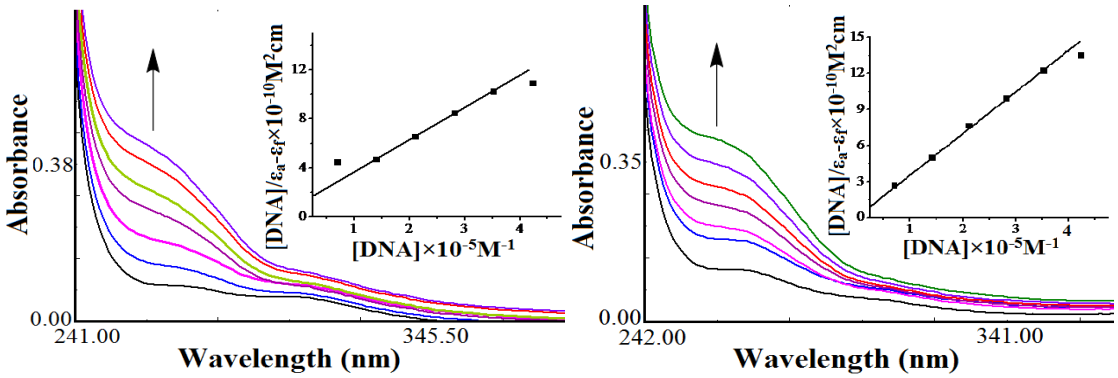


Fig. S5. Absorption spectra of complexes (a) **1** and (b) **2** in Tris–HCl buffer upon the addition of calf thymus DNA [complex] = 6.67×10^{-6} M, [DNA] = $(0.70–4.24)\times10^{-5}$ M. Arrow shows change in intensity with increasing concentration of DNA. Inset: plots of $[DNA]/(\varepsilon_a–\varepsilon_f)$ verses [DNA] for the titration of DNA with the complex.

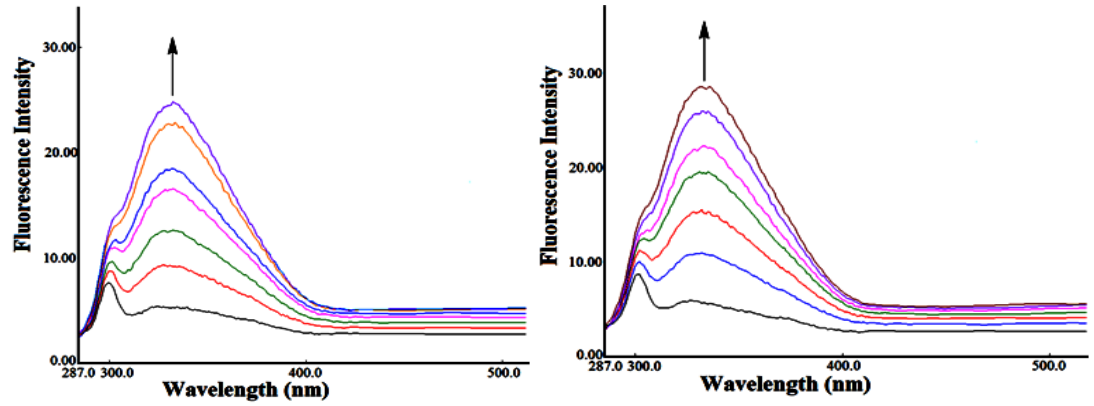


Fig. S6. Emission spectra of (a) complex **1**, (b) complex **2** in Tris–HCl buffer (pH 7.2) in the presence and absence of CT DNA at room temperature. Arrow shows change in intensity with increasing concentration of DNA.

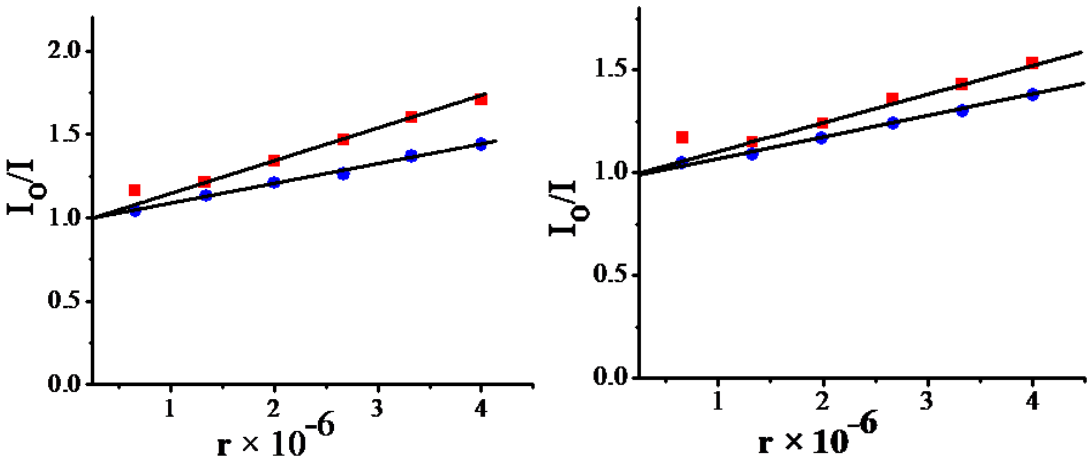


Fig. S7. Emission quenching curves of (a) complex **1** and (b) complex **2** with increasing concentration of $[Fe(CN)_6]^{4-}$ in the absence (■) and in the presence of CT–DNA (●). [M] = 6.67×10^{-6} M, [DNA] = 0.70×10^{-5} to 4.24×10^{-5} M.

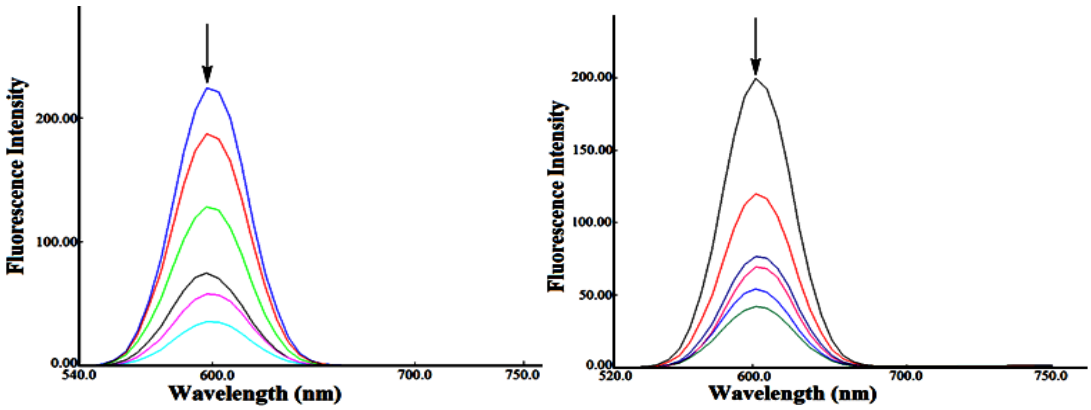


Fig. S8. Emission quenching spectra of CT DNA bound ethidium bromide in the presence of (a) complex **1** and (b) complex **2**, in buffer 5 mM Tris–HCl/50 mM NaCl, pH = 7.2 at 25 C. Arrow shows change in intensity with increasing concentration of ethidium bromide.

Table S1: Change in spectral features of complexes **1** and **2** on interaction with CT DNA in 5 mM Tris–HCl/50 mM NaCl buffer (pH 7.2).

Complex	K_b (M^{-1})	Monitored at (nm)	% Hyperchromism
1	6.7×10^5	271.77	31.57
2	3.5×10^5	267.79	23.68

Table S2: % Control growth at different concentration (µg/ml) of complex **1, 2** and ADR against various human carcinoma cell lines: U373MG (CNS), PC3 (Prostate), Hop62 (Lung), HL60 (Leukemia), HCT15 (Colon), A2780 (Ovarian) and HeLa (Cervix).

	Human CNS Cancer Cell Line U373MG															
	% Control Growth															
	Drug Concentrations (µg/ml)															
	Experiment 1				**Experiment 2**				**Experiment 3**				**Average Values**			
	10	**20**	**40**	**80**	**10**	**20**	**40**	**80**	**10**	**20**	**40**	**80**	**10**	**20**	**40**	**80**
2	100.0	100.0	63.8	11.9	100.0	80.2	48.3	10.9	96.7	85.2	46.1	19.5	98.9	88.5	52.7	14.1
1	-44.0	-47.8	-58.8	-67.6	-58.4	-59.8	-61.3	-70.1	-52.8	-55.0	-55.8	-58.8	-51.7	-54.2	-58.6	-65.5
ADR	-10.9	-19.1	-36.6	-38.6	-15.0	-21.0	-39.5	-45.1	-15.5	-20.2	-44.4	-45.5	-13.8	-20.1	-40.1	-43.1

	Human Prostate Cancer Cell Line PC3															
	% Control Growth															
	Drug Concentrations (µg/ml)															
	Experiment 1				**Experiment 2**				**Experiment 3**				**Average Values**			
	10	**20**	**40**	**80**	**10**	**20**	**40**	**80**	**10**	**20**	**40**	**80**	**10**	**20**	**40**	**80**
ZSQ	86.5	50.5	53.3	12.3	77.4	63.4	42.0	20.9	73.0	61.0	41.3	53.5	79.0	58.3	45.6	28.9
MZQ	-43.0	-44.8	-49.5	-52.9	-42.8	-46.6	-54.3	-55.4	-36.2	-44.3	-45.6	-52.9	-40.7	-45.3	-49.8	-53.7
ADR	-51.5	-53.2	-58.3	-59.8	-51.8	-58.0	-58.4	-64.7	-53.2	-59.3	-60.9	-63.1	-52.2	-56.8	-59.2	-62.5

	Human Lung Cancer Cell Line Hop62															
	% Control Growth															
	Drug Concentrations (µg/ml)															
	Experiment 1				**Experiment 2**				**Experiment 3**				**Average Values**			
	10	**20**	**40**	**80**	**10**	**20**	**40**	**80**	**10**	**20**	**40**	**80**	**10**	**20**	**40**	**80**
ZSQ	80.0	47.5	28.4	13.0	71.7	56.5	45.1	30.2	72.7	63.3	48.7	33.4	74.8	55.8	40.7	25.5
MZQ	-16.7	-21.6	-38.9	-45.1	-28.6	-50.9	-53.3	-56.1	-25.1	-43.7	-50.4	-59.3	-23.5	-38.7	-47.5	-53.5
ADR	-7.0	-13.0	-20.2	-21.4	-11.9	-15.4	-16.0	-16.3	-8.2	-18.9	-23.3	-24.2	-9.1	-15.8	-19.8	-20.6

	Human Leukemia Cell Line HL60															
	% Control Growth															
	Drug Concentrations (µg/ml)															
	Experiment 1				Experiment 2				Experiment 3				Average Values			
	10	20	40	80	10	20	40	80	10	20	40	80	10	20	40	80
ZSQ	71.4	47.5	44.5	26.5	66.8	36.9	23.8	15.4	82.0	42.9	39.2	26.9	73.4	42.4	35.8	23.0
MZQ	24.3	12.0	5.8	4.0	21.7	10.0	8.8	4.2	21.2	7.1	1.5	-3.5	22.4	9.7	5.4	1.6
ADR	14.2	-0.4	-3.0	-7.9	8.0	7.4	5.3	0.4	15.8	15.0	12.0	11.1	12.7	7.3	4.8	1.2

	Human Colon Cancer Cell Line HCT15															
	% Control Growth															
	Drug Concentrations (µg/ml)															
	Experiment 1				Experiment 2				Experiment 3				Average Values			
	10	20	40	80	10	20	40	80	10	20	40	80	10	20	40	80
ZSQ	100.0	90.7	45.0	22.6	100.0	80.3	39.0	25.3	89.6	72.9	40.8	25.4	96.5	81.3	41.6	24.4
MZQ	-46.4	-56.3	-58.2	-60.3	-40.3	-56.2	-56.5	-57.5	-45.4	-51.6	-50.8	-58.1	-44.0	-54.7	-55.2	-58.6
ADR	-18.5	-23.4	-27.4	-37.0	-21.6	-22.1	-23.4	-28.0	-15.2	-15.3	-16.7	-24.9	-18.4	-20.3	-22.5	-30.0

	Human Ovarian Cancer Cell Line A2780															
	% Control Growth															
	Drug Concentrations (µg/ml)															
	Experiment 1				Experiment 2				Experiment 3				Average Values			
	10	20	40	80	10	20	40	80	10	20	40	80	10	20	40	80
ZSQ	91.5	70.4	62.6	11.2	100.0	80.0	59.2	7.9	91.9	80.4	49.8	19.1	94.5	76.9	57.2	12.7
MZQ	100.0	100.0	100.0	90.5	100.0	100.0	100.0	5.2	100.0	100.0	100.0	90.9	100.0	100.0	100.0	62.2
ADR	76.0	68.2	29.1	7.3	80.0	54.2	33.9	1.8	61.2	34.4	20.2	8.2	72.4	52.3	27.7	5.8

	Human Cervix Cancer Cell Line HeLa															
	% Control Growth															
	Drug Concentrations (µg/ml)															
	Experiment 1				Experiment 2				Experiment 3				Average Values			
	10	20	40	80	10	20	40	80	10	20	40	80	10	20	40	80
ZSQ	40.7	15.4	-11.0	-14.6	32.7	13.6	-12.1	-13.1	27.3	11.4	-10.8	-21.1	33.5	13.4	-11.3	-16.3
MZQ	-57.9	-64.6	-66.9	-69.9	-61.8	-68.3	-73.3	-74.9	-66.7	-72.5	-74.4	-75.6	-62.1	-68.5	-71.5	-73.5
ADR	-52.3	-66.8	-67.3	-67.8	-61.0	-73.6	-75.2	-76.2	-68.0	-76.3	-76.7	-78.3	-60.4	-72.2	-73.1	-74.1