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Generating a potent inhibitor against MCF7 breast cancer cell through artificial intelligence based virtual screening and molecular docking studies

Latha V[1]*, Gomathi V[2], Rajeshkanna A[3] & Hari Ram S[4]

[1]Department of Chemistry; & [3]Dartmenent of Computer Science, Sri S. Ramasamy Naidu Memorial College, Sattur-626 203, Tamil Nadu, India

[2]Department of CSE; & [4]Department of CSE, National Engineering College, Kovilpatti-628 503, Tamil Nadu, India

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Supplementary data

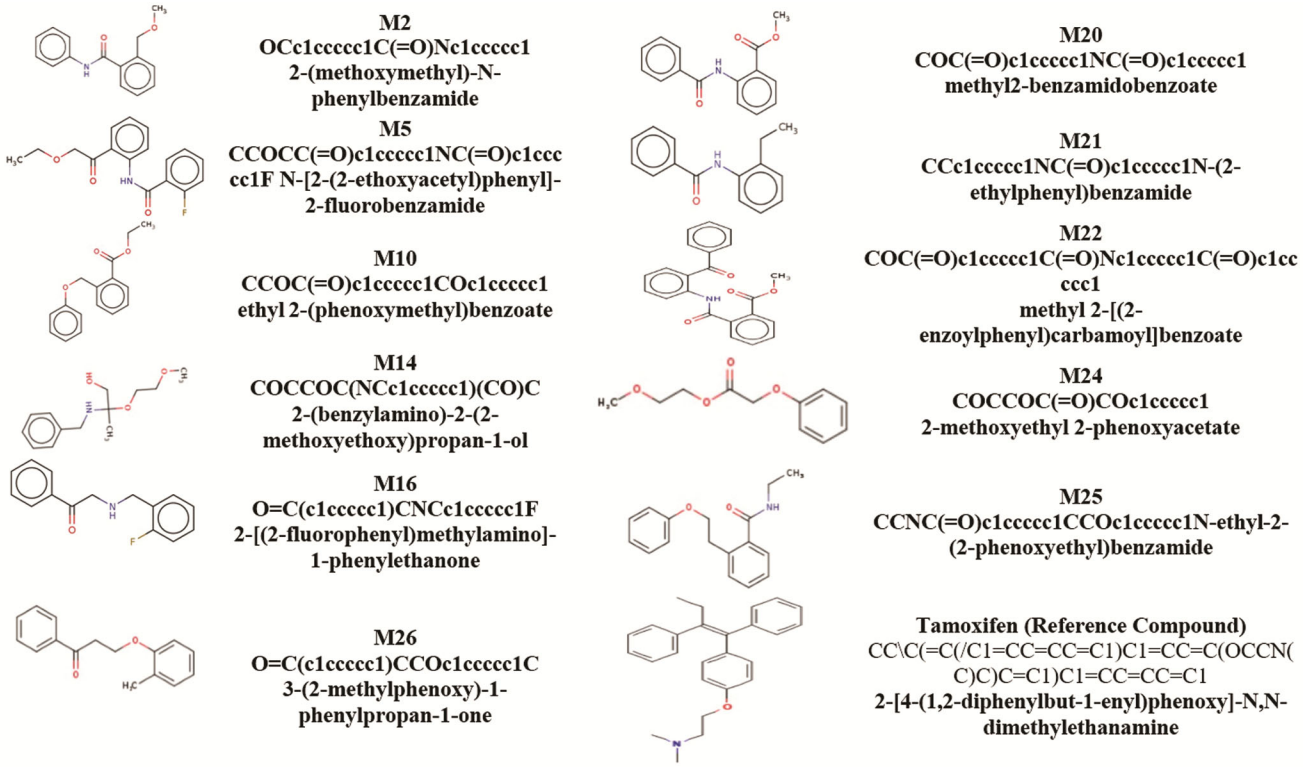

Fig. S1 — Consideration of drug-like compounds (M2, M5, M10, M14, M16, M20-M22, M24-M26)

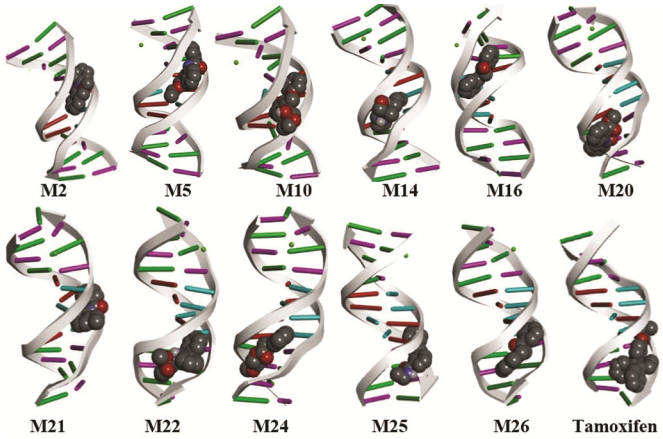

Fig. S2 — Molecular Docking Poses of drug-like inhibitors (M2, M5, M10, M14, M16, M20-M22, M24-M26) and Tamoxifen with DNA

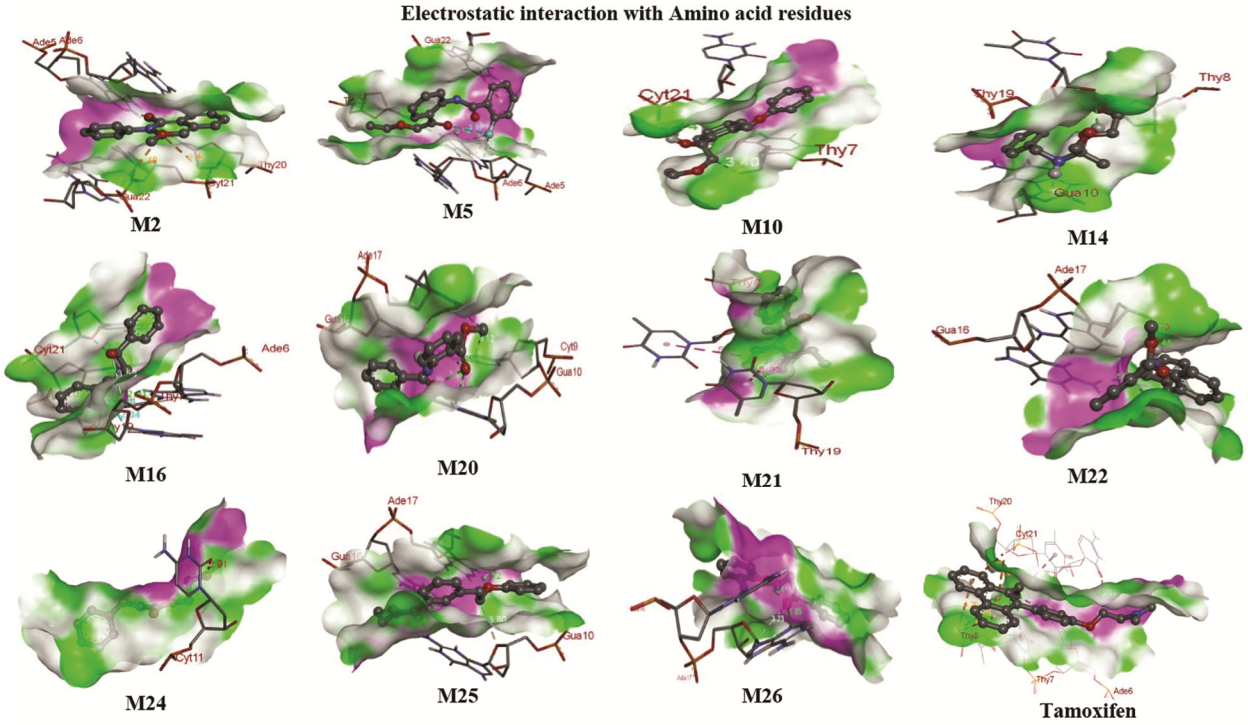

Fig. S3 — Electrostatic interactions of drug-like inhibitors (M2, M5, M10, M14, M16, M20-M22, M24-M26 and Tamoxifen)with amino acid residues in the binding pocket of 355D DNA receptor

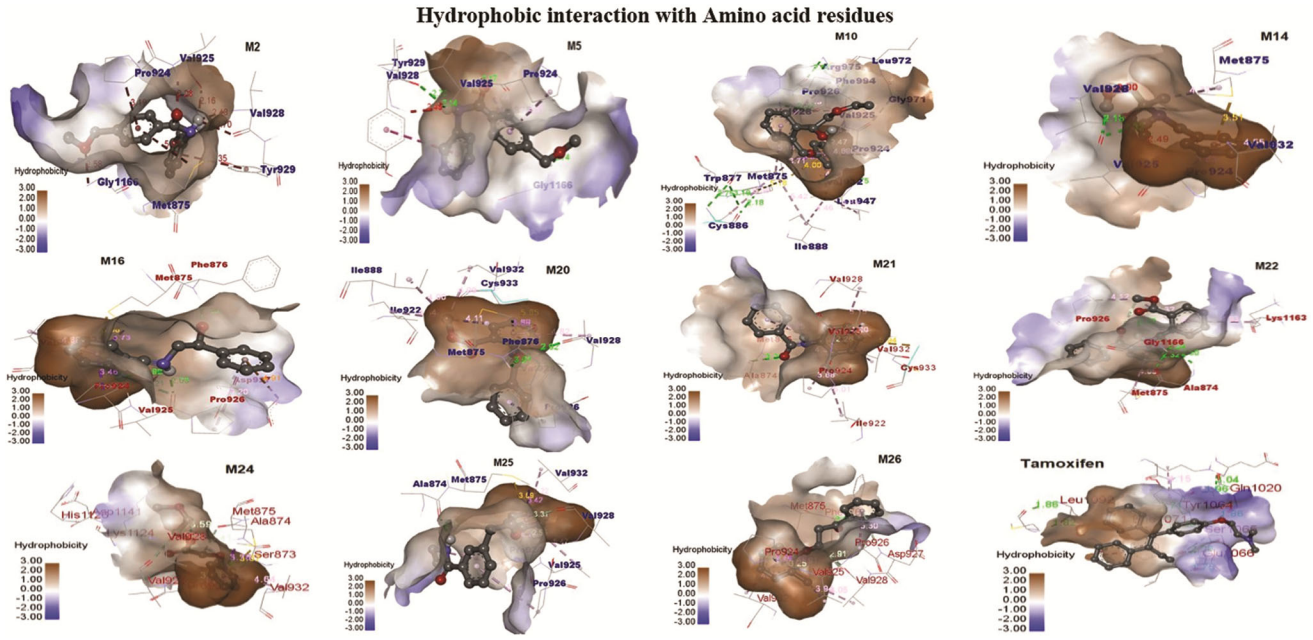

Fig. S4 — Hydrophobic interactions of drug-like inhibitors (M2, M5, M10, M14, M16, M20-M22, M24-M26 and Tamoxifen)with amino acid residues in the binding pocket of 3EU7 Protease receptor

Table S1 — Bonding interactions, type and distances of lead compounds with DNA

Donor		Acceptor		Distance(Å)	Category	Type
			Molecule ID-M2			
M2:O	Positive	B:DC21:OP1	Negative	5.4	Electrostatic	Attractive Charge
M2:O	Positive	B:DG22:OP1	Negative	5.49	Electrostatic	Attractive Charge
A:DA6:H3	H-Donor	M2:O	H-Acceptor	2.15	Hydrogen Bond	Conventional Hydrogen Bond
M2:O	H-Donor	B:DT20:O2	H-Acceptor	2.42	Hydrogen Bond	Conventional Hydrogen Bond
A:DA5:C2	H-Donor	M2:O	H-Acceptor	3.1	Hydrogen Bond	Carbon Hydrogen Bond
			Molecule ID-M5			
A:DA5:H3	H-Donor	M5:O	H-Acceptor	2.18	Hydrogen Bond	Conventional Hydrogen Bond
A:DA5:H3	H-Donor;Halogen Acceptor	M5:F	H-Acceptor; Halogen	2.66	HydrogenBond; Halogen	Conventional Hydrogen Bond;Halogen (Fluorine)
A:DA6:C5'	H-Donor	M5:F	H-Acceptor	3.52	Hydrogen Bond	Carbon Hydrogen Bond
M5:C	H-Donor	B:DT20:O2	H-Acceptor	2.99	Hydrogen Bond	Carbon Hydrogen Bond
A:DA5:N9	Halogen Acceptor	M5:F	Halogen	3.67	Halogen	Halogen (Fluorine)
M5	Halogen Acceptor	M5:F	Halogen	3.57	Halogen	Halogen (Fluorine)
B:DG22	Pi-Orbitals	M5:O	Pi-Orbitals	5.55	Hydrophobic	Pi-Pi T-shaped

(*Contd.*)

Table S1 — Bonding interactions, type and distances of lead compounds with DNA (*Contd*.)

Donor		Acceptor		Distance(Å)	Category	Type
			Molecule ID-M10			
M10:H	H-Donor	B:DC21:OP1	H-Acceptor	1.74	Hydrogen Bond	Conventional Hydrogen Bond
M10:C	H-Donor	A:DT7:O3'	H-Acceptor	3.4	Hydrogen Bond	Carbon Hydrogen Bond
			Molecule ID-M14			
M14:HN	H-Donor	A:DG10:OP1	H-Acceptor	2.09	Hydrogen Bond	Conventional Hydrogen Bond
M14:H	H-Donor	B:DT19:O3'	H-Acceptor	2.89	Hydrogen Bond	Conventional Hydrogen Bond
M14:C	H-Donor	A:DT8:O2	H-Acceptor	3.63	Hydrogen Bond	Carbon Hydrogen Bond
			Molecule ID-M16			
A:DA6:H3	H-Donor;Halogen Acceptor	M16:F	H-Acceptor; Halogen	2.91	HydrogenBond; Halogen	Conventional Hydrogen Bond;Halogen (Fluorine)
M16:H	H-Donor	B:DT20:O2	H-Acceptor	2.19	Hydrogen Bond	Conventional Hydrogen Bond
M16:H	H-Donor	B:DC21:O4	H-Acceptor	2.74	Hydrogen Bond	Conventional Hydrogen Bond
A:DA6:C2	H-Donor	M16:F	H-Acceptor	2.86	Hydrogen Bond	Carbon Hydrogen Bond
A:DT7:C5'	H-Donor	M16:O	H-Acceptor	3.53	Hydrogen Bond	Carbon Hydrogen Bond
A:DT7:O2	Halogen Acceptor	M16:F	Halogen	2.64	Halogen	Halogen (Fluorine)
B:DT19:O2	Halogen Acceptor	M16:F	Halogen	2.86	Halogen	Halogen (Fluorine)
B:DT20:O2	Halogen Acceptor	M16:F	Halogen	3.4	Halogen	Halogen (Fluorine)
			Molecule ID-M20			
A:DG10:H22	H-Donor	M20:O	H-Acceptor	1.67	Hydrogen Bond	Conventional Hydrogen Bond
A:DG10:H3	H-Donor	M20:O	H-Acceptor	2.39	Hydrogen Bond	Conventional Hydrogen Bond
A:DG10:H3	H-Donor	M20:O	H-Acceptor	3	Hydrogen Bond	Conventional Hydrogen Bond
B:DG16:H21	H-Donor	M20:O	H-Acceptor	2.95	Hydrogen Bond	Conventional Hydrogen Bond
M20:O	H-Donor	M20:O	H-Acceptor	2.79	Hydrogen Bond	Conventional Hydrogen Bond
M20:C	H-Donor	A:DC9:O2	H-Acceptor	3.12	Hydrogen Bond	Carbon Hydrogen Bond
B:DA17	Pi-Orbitals	M20:C	Alkyl	5	Hydrophobic	Pi-Alkyl
			Molecule ID-M21			
A:DT8	Pi-Orbitals	M21	Pi-Orbitals	5.62	Hydrophobic	Pi-Pi Stacked
B:DT19	Pi-Orbitals	M21	Pi-Orbitals	5.85	Hydrophobic	Pi-Pi Stacked
			Molecule ID-M22			
B:DG16:H22	H-Donor	M22:O	H-Acceptor	1.97	Hydrogen Bond	Conventional Hydrogen Bond

(*Contd*.)

Table S1 — Bonding interactions, type and distances of lead compounds with DNA (*Contd.*)

Donor		Acceptor		Distance(Å)	Category	Type
M22:H	H-Donor	B:DA17:O3'	H-Acceptor	1.99	Hydrogen Bond	Conventional Hydrogen Bond
M22:H	H-Donor	M22:O	H-Acceptor	2.41	Hydrogen Bond	Conventional Hydrogen Bond
M22:O	H-Donor	M22:O	H-Acceptor	2.25	Hydrogen Bond	Conventional Hydrogen Bond
			Molecule ID-M25			
A:DC11:O2	H-Acceptor	M24:O	H-Acceptor	2.81	Unfavorable	Unfavorable Acceptor
A:DG10:H22	H-Donor	M25:O	H-Acceptor	1.68	Hydrogen Bond	Conventional Hydrogen Bond
B:DG16:H22	H-Donor	M25:O	H-Acceptor	2.83	Hydrogen Bond	Conventional Hydrogen Bond
B:DG16:H3	H-Donor	M25:O	H-Acceptor	3.06	Hydrogen Bond	Conventional Hydrogen Bond
B:DA17:H3	H-Donor	M25:O	H-Acceptor	2.12	Hydrogen Bond	Conventional Hydrogen Bond
M25:C	H-Donor	A:DG10:O4'	H-Acceptor	3.6	Hydrogen Bond	Carbon Hydrogen Bond
			Molecule ID-M26			
B:DG16:H22	H-Donor	:M26:O	H-Acceptor	2.45	Hydrogen Bond	Conventional Hydrogen Bond
B:DA17:H3	H-Donor	: M26:O	H-Acceptor	1.65	Hydrogen Bond	Conventional Hydrogen Bond
B:DA17:C1'	H-Donor	: M26:O	H-Acceptor	3.23	Hydrogen Bond	Carbon Hydrogen Bond

Table S2 — Bonding interactions, type and distances of inhibitors with breast cancerprotease, 3EU7

Donor		Acceptor		Distance(Å)	Category	Type
			Molecule ID-M2			
A:VAL925:HN	H-Donor	:M2:O	H-Acceptor	2.28	Hydrogen Bond	Conventional Hydrogen Bond
A:GLY1166:HN	H-Donor	:M2:O	H-Acceptor	2.58	Hydrogen Bond	Conventional Hydrogen Bond
:M2:HN	H-Donor	A:VAL925:O	H-Acceptor	2.16	Hydrogen Bond	Conventional Hydrogen Bond
:M2:HN	H-Donor	A:VAL928:O	H-Acceptor	2.7	Hydrogen Bond	Conventional Hydrogen Bond
A:PRO924:CB	C-H	:M2	Pi-Orbitals	3.19	Hydrophobic	Pi-Sigma
A:TYR929	Pi-Orbitals	:M2	Pi-Orbitals	5.35	Hydrophobic	Pi-Pi T-shaped
			Molecule ID-M5			
A:VAL925:HN	H-Donor	:M5:O	H-Acceptor	2.17	Hydrogen Bond	Conventional Hydrogen Bond
A:GLY1166:HN	H-Donor	:M5:O	H-Acceptor	2.74	Hydrogen Bond	Conventional Hydrogen Bond
:M5:HN	H-Donor	A:VAL925:O	H-Acceptor	2.14	Hydrogen Bond	Conventional Hydrogen Bond
:M5:HN	H-Donor	A:VAL928:O	H-Acceptor	2.7	Hydrogen Bond	Conventional Hydrogen Bond

(*Contd.*)

Table S2 — Bonding interactions, type and distances of inhibitors with breast cancerprotease, 3EU7 (Contd.)

Donor		Acceptor		Distance(Å)	Category	Type
A:TYR929	Pi-Orbitals	:M5	Pi-Orbitals	5.21	Hydrophobic	Pi-Pi T-shaped
:M5	Pi-Orbitals	A:MET875	Alkyl	5.44	Hydrophobic	Pi-Alkyl
:M5	Pi-Orbitals	A:PRO924	Alkyl	4.31	Hydrophobic	Pi-Alkyl
			Molecule ID-M10			
A:VAL925:HN	H-Donor	:M10	Pi-Orbitals	2.47	Hydrogen Bond	Pi-Donor Hydrogen Bond
A:MET875:CE	C-H	: M10	Pi-Orbitals	3.56	Hydrophobic	Pi-Sigma
A:MET875:SD	Sulfur	A:TRP877	Pi-Orbitals	5.18	Other	Pi-Sulfur
A:MET875:SD	Sulfur	: M10	Pi-Orbitals	4	Other	Pi-Sulfur
: M10:C	Alkyl	A:MET875	Alkyl	3.71	Hydrophobic	Alkyl
: M10:C	Alkyl	A:PRO924	Alkyl	4.68	Hydrophobic	Alkyl
A:PHE994	Pi-Orbitals	A:VAL925	Alkyl	5.47	Hydrophobic	Pi-Alkyl
: M10	Pi-Orbitals	A:MET875	Alkyl	5.14	Hydrophobic	Pi-Alkyl
: M10	Pi-Orbitals	A:PRO926	Alkyl	5.49	Hydrophobic	Pi-Alkyl
: M10	Pi-Orbitals	A:PRO924	Alkyl	5.21	Hydrophobic	Pi-Alkyl
: M10	Pi-Orbitals	A:VAL925	Alkyl	4.99	Hydrophobic	Pi-Alkyl
: M10	Pi-Orbitals	A:VAL932	Alkyl	4.96	Hydrophobic	Pi-Alkyl
			Molecule ID-M14			
:M14:H	H-Donor	A:VAL925:O	H-Acceptor	2.32	Hydrogen Bond	Conventional Hydrogen Bond
: M14:H	H-Donor	A:VAL925:O	H-Acceptor	2.18	Hydrogen Bond	Conventional Hydrogen Bond
A:PRO924:CA	C-H	: M14	Pi-Orbitals	3.63	Hydrophobic	Pi-Sigma
A:MET875:SD	Sulfur	: M14	Pi-Orbitals	3.51	Other	Pi-Sulfur
: M14:C	Alkyl	A:MET875	Alkyl	4.77	Hydrophobic	Alkyl
: M14	Pi-Orbitals	A:VAL932	Alkyl	4.55	Hydrophobic	Pi-Alkyl
			Molecule ID-M16			
A:PHE876:HN	H-Donor	:M16:O	H-Acceptor	3.01	Hydrogen Bond	Conventional Hydrogen Bond
:M16:O	H-Donor	A:VAL928:O	H-Acceptor	2.92	Hydrogen Bond	Conventional Hydrogen Bond
: M16:H	H-Donor	A:VAL925:O	H-Acceptor	2.18	Hydrogen Bond	Conventional Hydrogen Bond
A:VAL925:HN	H-Donor	: M16	Pi-Orbitals	2.17	Hydrogen Bond	Pi-Donor Hydrogen Bond
A:MET875:CE	C-H	: M16	Pi-Orbitals	3.68	Hydrophobic	Pi-Sigma
A:VAL925:CG2	C-H	: M16	Pi-Orbitals	3.97	Hydrophobic	Pi-Sigma
A:CYS933:SG:B	Sulfur	: M16	Pi-Orbitals	5.65	Other	Pi-Sulfur
: M16:C	Alkyl	A:MET875	Alkyl	4.11	Hydrophobic	Alkyl
: M16:C	Alkyl	A:ILE888	Alkyl	4	Hydrophobic	Alkyl
: M16:C	Alkyl	A:ILE922	Alkyl	4.34	Hydrophobic	Alkyl
: M16:C	Alkyl	A:VAL932	Alkyl	4.09	Hydrophobic	Alkyl
: M16	Pi-Orbitals	A:PRO926	Alkyl	4.5	Hydrophobic	Pi-Alkyl
: M16	Pi-Orbitals	A:VAL928	Alkyl	4.82	Hydrophobic	Pi-Alkyl
A:PHE876:HN	H-Donor	: M20:O	H-Acceptor	3.01	Hydrogen Bond	Conventional Hydrogen Bond
			Molecule ID-M20			
: M20:O	H-Donor	A:VAL928:O	H-Acceptor	2.92	Hydrogen Bond	Conventional Hydrogen Bond

(*Contd*.)

Table S2 — Bonding interactions, type and distances of inhibitors with breast cancerprotease, 3EU7 (Contd.)

Donor		Acceptor		Distance(Å)	Category	Type
: M20:H	H-Donor	A:VAL925:O	H-Acceptor	2.18	Hydrogen Bond	Conventional Hydrogen Bond
A:VAL925:HN	H-Donor	: M20	Pi-Orbitals	2.17	Hydrogen Bond	Pi-Donor Hydrogen Bond
A:MET875:CE	C-H	: M20	Pi-Orbitals	3.68	Hydrophobic	Pi-Sigma
A:VAL925:CG2	C-H	: M20	Pi-Orbitals	3.97	Hydrophobic	Pi-Sigma
A:CYS933:SG:B	Sulfur	: M20	Pi-Orbitals	5.65	Other	Pi-Sulfur
: M20:C	Alkyl	A:MET875	Alkyl	4.11	Hydrophobic	Alkyl
: M20:C	Alkyl	A:ILE888	Alkyl	4	Hydrophobic	Alkyl
: M20:C	Alkyl	A:ILE922	Alkyl	4.34	Hydrophobic	Alkyl
: M20:C	Alkyl	A:VAL932	Alkyl	4.09	Hydrophobic	Alkyl
: M20	Pi-Orbitals	A:PRO926	Alkyl	4.5	Hydrophobic	Pi-Alkyl
: M20	Pi-Orbitals	A:VAL928	Alkyl	4.82	Hydrophobic	Pi-Alkyl
:M20:O	H-Donor	A:ALA874:O	H-Acceptor	3.2	Hydrogen Bond	Conventional Hydrogen Bond
			Molecule ID-M21			
A:VAL925:HN	H-Donor	:M21	Pi-Orbitals	2.26	Hydrogen Bond	Pi-Donor Hydrogen Bond
A:MET875:CE	C-H	: M21	Pi-Orbitals	3.45	Hydrophobic	Pi-Sigma
: M21:C	Alkyl	A:MET875	Alkyl	4.34	Hydrophobic	Alkyl
: M21:C	Alkyl	A:ILE922	Alkyl	5.01	Hydrophobic	Alkyl
: M21:C	Alkyl	A:PRO924	Alkyl	3.88	Hydrophobic	Alkyl
: M21	Pi-Orbitals	A:MET875	Alkyl	5.25	Hydrophobic	Pi-Alkyl
: M21	Pi-Orbitals	A:VAL925	Alkyl	4.6	Hydrophobic	Pi-Alkyl
: M21	Pi-Orbitals	A:VAL928	Alkyl	5.15	Hydrophobic	Pi-Alkyl
: M21	Pi-Orbitals	A:VAL932	Alkyl	5.37	Hydrophobic	Pi-Alkyl
			Molecule ID-M22			
A:ALA874:HN	H-Donor	:M22:O	H-Acceptor	2.5	Hydrogen Bond	Conventional Hydrogen Bond
A:GLY1166:HN	H-Donor	: M22:O	H-Acceptor	2.24	Hydrogen Bond	Conventional Hydrogen Bond
: M22:H	H-Donor	: M22:O	H-Acceptor	2.3	Hydrogen Bond	Conventional Hydrogen Bond
: M22:O	H-Donor	A:ALA874:O	H-Acceptor	2.32	Hydrogen Bond	Conventional Hydrogen Bond
: M22:C	H-Donor	: M22:O	H-Acceptor	3.45	Hydrogen Bond	Carbon Hydrogen Bond
: M22:C	Alkyl	A:PRO924	Alkyl	4.32	Hydrophobic	Alkyl
: M22:C	Alkyl	A:PRO926	Alkyl	4.12	Hydrophobic	Alkyl
: M22	Pi-Orbitals	A:MET875	Alkyl	4.05	Hydrophobic	Pi-Alkyl
: M22	Pi-Orbitals	A:PRO924	Alkyl	4.06	Hydrophobic	Pi-Alkyl
:M22	Pi-Orbitals	A:PRO924	Alkyl	4.26	Hydrophobic	Pi-Alkyl
: M22	Pi-Orbitals	A:LYS1163	Alkyl	4.93	Hydrophobic	Pi-Alkyl
			Molecule ID-M24			
A:SER873:HG	H-Donor	:M24:O	H-Acceptor	2.74	Hydrogen Bond	Conventional Hydrogen Bond
: M24:C	H-Donor	A:VAL925:O	H-Acceptor	3.73	Hydrogen Bond	Carbon Hydrogen Bond
: M24:C	H-Donor	A:ALA874:O	H-Acceptor	3.41	Hydrogen Bond	Carbon Hydrogen Bond

(*Contd.*)

Table S2 — Bonding interactions, type and distances of inhibitors with breast cancerprotease, 3EU7 (Contd.)

Donor		Acceptor		Distance(Å)	Category	Type
A:VAL925:HN	H-Donor	: M24	Pi-Orbitals	3.08	Hydrogen Bond	Pi-Donor Hydrogen Bond
A:MET875:CE	C-H	: M24	Pi-Orbitals	3.76	Hydrophobic	Pi-Sigma
A:PRO924:CA	C-H	: M24	Pi-Orbitals	3.5	Hydrophobic	Pi-Sigma
A:MET875:SD	Sulfur	: M24	Pi-Orbitals	3.67	Other	Pi-Sulfur
			Molecule ID-M25			
:M25:HN	H-Donor	A:ALA874:O	H-Acceptor	2.13	Hydrogen Bond	Conventional Hydrogen Bond
: M25:C	H-Donor	A:VAL928:O	H-Acceptor	3.31	Hydrogen Bond	Carbon Hydrogen Bond
A:VAL925:HN	H-Donor	:M25	Pi-Orbitals	2.55	Hydrogen Bond	Pi-Donor Hydrogen Bond
A:MET875:CE	C-H	:M25	Pi-Orbitals	3.42	Hydrophobic	Pi-Sigma
A:PRO924:CA	C-H	:M25	Pi-Orbitals	3.49	Hydrophobic	Pi-Sigma
:M25:C	Alkyl	A:PRO924	Alkyl	4.93	Hydrophobic	Alkyl
:M25	Pi-Orbitals	A:VAL925	Alkyl	5.47	Hydrophobic	Pi-Alkyl
:M25	Pi-Orbitals	A:VAL932	Alkyl	5.22	Hydrophobic	Pi-Alkyl
:M25	Pi-Orbitals	A:PRO926	Alkyl	5.3	Hydrophobic	Pi-Alkyl
			Molecule ID-M26			
A:PHE876:HN	H-Donor	:M26:O	H-Acceptor	2.08	Hydrogen Bond	Conventional Hydrogen Bond
: M26:C	H-Donor	A:VAL925:O	H-Acceptor	2.91	Hydrogen Bond	Carbon Hydrogen Bond
: M26:C	H-Donor	A:VAL928:O	H-Acceptor	3.76	Hydrogen Bond	Carbon Hydrogen Bond
A:VAL925:HN	H-Donor	: M26	Pi-Orbitals	3.25	Hydrogen Bond	Pi-Donor Hydrogen Bond
A:ASP927:HN	H-Donor	: M26	Pi-Orbitals	3.02	Hydrogen Bond	Pi-Donor Hydrogen Bond
A:MET875:CE	C-H	: M26	Pi-Orbitals	3.44	Hydrophobic	Pi-Sigma
A:PRO924:CA	C-H	: M26	Pi-Orbitals	3.74	Hydrophobic	Pi-Sigma
A:MET875:SD	Sulfur	: M26	Pi-Orbitals	3.31	Other	Pi-Sulfur
: M26:C	Alkyl	A:MET875	Alkyl	4.91	Hydrophobic	Alkyl
: M26:C	Alkyl	A:VAL925	Alkyl	3.94	Hydrophobic	Alkyl
: M26:C	Alkyl	A:VAL928	Alkyl	4.05	Hydrophobic	Alkyl
: M26	Pi-Orbitals	A:PRO926	Alkyl	5.3	Hydrophobic	Pi-Alkyl
: M26	Pi-Orbitals	A:VAL932	Alkyl	4.7	Hydrophobic	Pi-Alkyl