Molecular Dimensions

The Morpheus® Additive Screen MD1–93

The Morpheus Additive Screen is a new 96-condition additive screen, containing an extensive library of ligands suitable for soluble and membrane proteins.

MD1-93 is presented as 96 x 100 µL conditions.

Features of The Morpheus Additive Screen:

- Test a large range of precipitants, stabilizers, buffers, nucleants, phasing compounds, cryoprotectants and surfactants all in one screen.
- Enhance stability and solubility of protein for crystallization with the inclusion of NDSBs, polyamines, monosaccharides and amino acids.
- Contains heavy atoms as additives for experimental phasing.
- Use in protein stability screen assays e.g. thermal shift assays.

Introduction

The Morpheus Additive Screen contains a library of additives for use in protein crystallization optimization experiments (Table 1 & 2).
These additives are a mixture of low molecular weight components typically found in many solved protein structures and have been found to aid with crystallization; also less typical additives which are meant to alter protein stability and solubility such as heavy metals, NDSBs, polyamines, monosaccharides and amino acids.

Notes:
The screen should preferably be frozen upon arrival and defrosted prior to use.
Gently mix the screen before use (invert the block several times then spin down <1000 rpm).
A light pellet may form in tubes containing Lanthanides (E1-E12). It is easily re-suspended with further gentle mixing.

How to use the Additive screen:

Additives may affect hydration and intermolecular interactions between protein molecules or between protein molecule and solvent/ligands and is the only optimization approach that can improve diffraction.

The Morpheus Additive Screen is provided in an easy-to-use 96-well plate that is compatible with dispensing robots.

We recommend you start with a classic optimization of the condition/s that favoured nucleation in the initial or adjusted screen. The first parameters to adjust are protein concentration, pH, and precipitant concentration. Once you can reproduce the initial experiment(s) you can screen additives.

Recommended set-up: Set-up your optimization screen and add 10% (v/v) of additive in reservoir or drop.

References

1. Gorrec, F (2009), The MORPHEUS protein crystallization screen *J Appl Cryst* **42**, 1035-1042

2. Gorrec, F (2013), The current approach to initial crystallization screening of proteins is under-sampled *J Appl Cryst* **46**, 795-797.

3. Gorrec, F (2015), The Morpheus II protein crystallization screen, ICCBM15 proceedings (Special Issue Acta Cryst F71, p. 831-837).

Formulation Notes:

The Morpheus Additive Screen reagents are formulated using ultrapure water (>18.0 MΩ) and are sterile-filtered using 0.22 µm filters. No preservatives are added. Material Safety Datasheets are available from our website.

Final pH may vary from that specified on the datasheet. Molecular Dimensions will be happy to discuss the precise formulation of individual reagents.
Individual reagents and stock solutions for optimization are available from Molecular Dimensions.

Enquiries regarding The Morpheus Additive Screen formulation, interpretation of results or optimization strategies are welcome. Please e-mail, fax or phone your query to Molecular Dimensions.

Contact and product details can be found at www.moleculardimensions.com

Re-Ordering details:

Catalogue Description	Pack size	Catalogue Code
Morpheus®	96 x 10 mL	MD1-46
Morpheus® HT-96	96 x 1 mL	MD1-47
Morpheus® FX	96 x 100 µL	MD1-47-FX
Morpheus® II	96 x 10 mL	MD1-91
Morpheus® II HT-96	96 x 1 mL	MD1-92
Morpheus® II FX-96	96 x 100 µL	MD1-92-FX
The Morpheus® Additive Screen	96 x 100 µL	MD1-93
Green Screens (contain fluorescent green dye - ideal for UV)		
Morpheus® Green Screen	96 x 10 mL	MD1-46-GREEN
Morpheus® HT-96 Green Screen	96 x 1 mL	MD1-47-GREEN
Single Reagents		
Morpheus® single reagents	100 mL	MDSR-46-tube number
Morpheus® HT-96 single reagents	100 mL	MDSR-47-well number
Morpheus® II single reagents	100 mL	MDSR-91-tube number
Morpheus® II HT-96 single reagents	100 mL	MDSR-92-well number

For Morpheus mixes and stock solutions please visit the Optimization section on our website.

Morpheus and Morpheus II has been designed and developed by Fabrice GORREC, in collaboration with the scientists at the Medical Research Council Laboratory of Molecular Biology (LMB) at Cambridge and is manufactured exclusively under license by Molecular Dimensions Limited.
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Table 1: List of PDB ligands* in Morpheus

PDB Ligand name(s)	Class	PDB ID(s)	Structure Hits*
1,2-Ethanediol (ethylene glycol)	Precipitant	EDO, EGL	1081
1,2-Propanediol (enantiomers R and S)	Alcohols	PGO, PGR	41
1,3-Propanediol	Alcohols	PDO	7
1,4-Butanediol	Alcohols	BU1	11
1,6-Hexanediol	Alcohols	HEZ	19
1-Butanol	Alcohols	1BO	7
2-(N-Morpholino)-ethane sulfonic acid (MES)	Buffer	MES	315
2-Amino-2-hydroxymethyl-propane-1,3-diol (Tris)	Buffer	TRS	334
2-Methyl-2,4-pentanediol (MPD, enantiomers R and S)	Precipitant	MPD, MRD	504
3-Morpholinopropane-1-sulfonic acid (MOPS)	Buffer	MPO	21
4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid (HEPES)	Buffer	EPE	201
Acetic acid, acetate, acetyl	Carboxylic acids	ACY, ACT, ACE	1890
(*S*)-2-Aminopropanoic acid (Alanine, (enantiomers L and D)	Amino acids	ALA, DAL	35
Amino, Ammonia, Ammonium	multiple	NH2, NH3, NH4	582
N,N-bis(2-hydroxyethyl)glycine (Bicine)	Buffer	BCN	13
Bromide	Halogens	BR	120
Calcium	Divalents	CA	3959
Chloride	Multiple	CL	2842
Citric acid, citrate	Carboxylic acids	CIT, FLC	384
D-Galactose (anomers α and β)	Monosaccharides	GAL, GLA	86
D-Glucose (anomers α and β)	Monosaccharides	GLC, BGC	206
Di(Hydroxyethyl)ether (Di-Ethyleneglycol)	Ethylene glycols	PEG	209
D-Mannose (anomers α and β)	Monosaccharides	MAN, BMA	178
D-Xylopyranose (anomers α and β)	Monosaccharides	XYL, XYP	41
Fluoride	Halogens	F	16
Formic acid	Carboxylic acids	FMT	267
Glutamic acid (enantiomers L and D)	Precipitant	GLU, DGL	75
Glycerol	Amino acids	GOL	2884
Glycine	Buffer	GLY	50
Imidazole	Halogens	IMD	154
Iodide	Alcohols	IOD	178
Isopropyl alcohol (iso-propanol, 2-Propanol)	Monosaccharides	IPA, IOH	174
L-Fucose (anomers α and β)	Amino acids	FUC, FUL	62
Lysine (enantiomers L and D)	Amino acids	LYS, DLY	36
Magnesium	Divalents	MG	3991
N-Acetyl-d-glucosamine (anomers α and β)	Monosaccharides	NAG,NBG	1150
Nitrate	NPS	NO3	156
Oxamic acid	Carboxylic acids	OXM	17
Penta(hydroxyethyl)ether (Penta-Ethyleneglycol)	Ethylene glycols	1PE	91
Phosphates	NPS	PO4, PI, 2HP	1687
Potassium	Carboxylic acids	K	720
Serine (enantiomers L and D)	Amino acids	SER, DSN	38
Sodium	multiple	NA	1926
Sulfate	NPS	SO4	5793
Tartaric acid (enantiomers R and S)	Carboxylic acids	TAR, TLA	113
Tetra(hydroxyethyl)ether (Tetra-Ethyleneglycol)	Ethylene glycols	PG4	194
Tri(Hydroxyethyl)ether (Tri-Ethyleneglycol)	Ethylene glycols	PGE	107
* as of July 2008.		**SUM**	32956

Table 2: List of PDB ligands in Morpheus II
(No. of Structures requested in December 2014)

PDB ligand name	Class	PDB ID (main)	No. of structures
Lithium sulfate	Common salt	LI	51
Sodium Chloride	Common salt	Na	4726
Potassium sulfate	Common salt	K	1638
Manganese chloride tetrahydrate	Divalent cation	MN	1938
Cobalt chloride hexahydrate	Divalent cation	CO	474
Nickel chloride hexahydrate	Divalent cation	NI	699
Zinc acetate dihydrate	Divalent cation	ZN	8413
Barium acetate	Alkali	BA	91
Cesium acetate	Alkali	CS	75
Rubidium chloride	Alkali	RB	34
Strontium acetate	Alkali	SR	101
Sodium chromate tetrahydrate	Oxometalate	CR	7
Sodium molybdate dihydrate	Oxometalate	MOO	20
sodium orthovanadate	Oxometalate	VO4	73
Sodium tungstate dihydrate	Oxometalate	WO4	47
Erbium(III) Chloride hexahydrate	Lanthanide	ER3	2
Terbium(III) Chloride hexahydrate	Lanthanide	TB	11
Ytterbium (III) Chloride hexahydrate	Lanthanide	YB	57
Yttrium (III) Chloride hexahydrate	Lanthanide	YT3	33
Xylitol	Monosaccharide	XYL	25
D-(-)-Fructose	Monosaccharide	FRU; FUD	36; 4
D-Sorbitol	Monosaccharide	SOR	12
myo-Inositol	Monosaccharide	INS	16
L-Rhamnose monohydrate	Monosaccharide	RAM	43
DL-Threonine	Amino-acid	DTH; THR	23; n/a
DL-Histidine, HCL, H20	Amino-acid	DHI; HIS	24; n/a
DL-5-Hydroxylysine, HCl	Amino-acid	n/a; LYZ	0; 7
trans-4-Hydroxy-L-proline	Amino-acid	HYP	149
Spermine, 4 HCl	Polyamine	SPM	103
spermidine, 3HCl	Polyamine	SPD	32
1,4-Diaminobutane, 2HCl	Polyamine	PUT	22
DL-Ornithine, HCl	Polyamine	ORD; ORN	3; 56
NDSB 256	Surfactant	DMX	4
NDSB 195	Surfactant	NDS	7
Bis-tris	buffer	BTB	114

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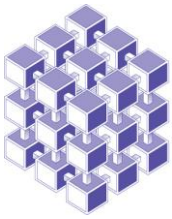
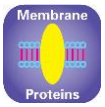
The Morpheus Additive Screen MD1-93 Wells A1-D12

Well #	Chemical name	known as/for	Conc
A1	Water	control	-
A2	PEG 20000	precipitant	20.00 % w/v
A3	PEG 500 MME	precipitant	40.00 % w/v
A4	PEG 8000	precipitant	20.00 % w/v
A5	Ethylene glycol	cryoprotectant	40.00 % v/v
A6	PEG 4000	precipitant	20.00 % w/v
A7	Glycerol	cryoprotectant	40.00 % v/v
A8	MPD	cryoprotectant	25.00 % v/v
A9	PEG 1000	precipitant	25.00 % w/v
A10	PEG 3350	precipitant	25.00 % w/v
A11	MES monohydrate	buffer (acid)	0.50 M
A12	Imidazole	buffer (base)	0.50 M
B1	MOPS	buffer (acid)	0.50 M
B2	Sodium HEPES	buffer (base)	0.50 M
B3	BICINE	buffer (acid)	0.50 M
B4	Trizma® base	buffer (base)	0.50 M
B5	Magnesium chloride hexahydrate	nucleant	0.60 M
B6	Calcium chloride dihydrate	nucleant	0.60 M
B7	Sodium fluoride	phasing	0.60 M
B8	Sodium bromide	phasing	0.60 M
B9	Sodium iodide	phasing	0.60 M
B10	Sodium nitrate	precipitant	0.60 M
B11	Sodium phosphate dibasic dihydrate	precipitant	0.30 M
B12	Ammonium sulfate	precipitant	0.60 M
C1	1-Butanol	precipitant	0.40 M
C2	1,4-Butanediol	precipitant	0.40 M
C3	1,2-Propanediol	precipitant	0.40 M
C4	1,3-Propanediol	precipitant	0.40 M
C5	2-Propanol	precipitant	0.40 M
C6	1,6-Hexanediol	precipitant	0.40 M
C7	Diethylene glycol	precipitant	0.60 M
C8	Triethylene glycol	precipitant	0.60 M
C9	Tetraethylene glycol	precipitant	0.60 M
C10	Pentaethylene glycol	precipitant	0.60 M
C11	N-Acetyl-D-glucosamine	stabilizer	0.40 M
C12	Fucose	stabilizer	0.40 M
D1	D-Galactose	stabilizer	0.40 M
D2	D-Glucose	stabilizer	0.40 M
D3	D-Xylose	stabilizer	0.40 M
D4	D-Mannose	stabilizer	0.40 M
D5	Ammonium acetate	precipitant	0.40 M
D6	Sodium oxamate	precipitant	0.40 M
D7	Sodium formate	precipitant	0.40 M
D8	Potassium sodium tartrate tetrahydrate	precipitant	0.40 M
D9	Sodium citrate tribasic dihydrate	precipitant	0.40 M
D10	DL-Glutamic acid monohydrate	stabilizer	0.40 M
D11	DL-Lysine monohydrochloride	stabilizer	0.40 M
D12	DL-Alanine	stabilizer	0.40 M





The Morpheus Additive Screen MD1–93 Wells E1-H12

Well #	Chemical name	known as/for	Conc	
E1	Glycine	stabilizer	0.40	M
E2	DL-Serine	stabilizer	0.40	M
E3	PEG 3000	precipitant	30.00	% w/v
E4	1,2,4-Butanetriol	cryoprotectant	40.00	% v/v
E5	NDSB 256	surfactant	4.00	% w/v
E6	1,2,6-Hexanetriol	cryoprotectant	40.00	% v/v
E7	1,5-Pentanediol	cryoprotectant	40.00	% v/v
E8	Trimethylolpropane	cryoprotectant	50.00	% w/v
E9	NDSB 195	surfactant	4.00	% w/v
E10	MOPSO	buffer (acid)	0.50	M
E11	Bis-Tris	buffer (base)	0.50	M
E12	BES	buffer (acid)	0.50	M
F1	TEA	buffer (base)	0.50	M
F2	Gly-Gly	buffer (acid)	0.50	M
F3	AMPD	buffer (base)	0.50	M
F4	Lithium sulfate	precipitant	0.60	M
F5	Sodium sulfate	precipitant	0.60	M
F6	Potassium sulfate	precipitant	0.60	M
F7	Manganese(II) chloride tetrahydrate	nucleant	0.02	M
F8	Cobalt(II) chloride hexahydrate	nucleant	0.02	M
F9	Nickel(II) chloride hexahydrate	nucleant	0.02	M
F10	Zinc acetate dihydrate	nucleant	0.02	M
F11	Barium acetate	phasing	0.02	M
F12	Cesium acetate	phasing	0.02	M
G1	Rubidium chloride	phasing	0.02	M
G2	Strontium acetate	phasing	0.02	M
G3	Sodium chromate tetrahydrate	phasing	0.01	M
G4	Sodium molybdate dihydrate	phasing	0.01	M
G5	Sodium orthovanadate	phasing	0.01	M
G6	Sodium tungstate dihydrate	phasing	0.01	M
G7	Erbium(III) chloride hexahydrate	phasing	0.01	M
G8	Terbium(III) chloride hexahydrate	phasing	0.01	M
G9	Ytterbium(III) chloride hexahydrate	phasing	0.01	M
G10	Yttrium(III) chloride hexahydrate	phasing	0.01	M
G11	Xylitol	cryoprotectant	0.40	M
G12	D-Fructose	cryoprotectant	0.40	M
H1	D-Sorbitol	cryoprotectant	0.40	M
H2	L-Rhamnose monohydrate	cryoprotectant	0.40	M
H3	*myo*-Inositol	cryoprotectant	0.40	M
H4	DL-Arginine hydrochloride	stabilizer	0.40	M
H5	DL-5-Hydroxylysine hydrochloride	stabilizer	0.40	M
H6	DL-Threonine	stabilizer	0.40	M
H7	*trans*-4-Hydroxy-L-proline	stabilizer	0.40	M
H8	DL-Histidine monohydrochloride monohydrate	stabilizer	0.40	M
H9	Spermine tetrahydrochloride	stabilizer	0.20	M
H10	Spermidine trihydrochloride	stabilizer	0.20	M
H11	1,4-Diaminobutane dihydrochloride	stabilizer	0.20	M
H12	DL-Ornithine monohydrochloride	stabilizer	0.20	M