Morpheus® 10 mL, HT-96 and FX-96 pre-filled plate MD1–46, MD1-47 and MD1-47-FX

Morpheus is a 96 condition 3D protein crystallization screen incorporating a range of low-molecular weight ligands with our fluorescent dye added for superb UV performance. Unlock novel chemical space previously inaccessible using conventional screens.

MD1-46 is presented as 96 x 10 mL conditions. MD1-47 is presented as 96 x 1 mL conditions. MD1-47-FX is presented as 96 x 100 µL conditions.

Features of Morpheus® Green screen:

- Fluorescent dye added for superb UV performance
- Simple and effective 3D grid design covering a range of pH, precipitants, PEGs and salt additives.
- Targeted incorporation of 49 low molecular weight ligands.
- Suitable for membrane proteins with PEGS and polyols as main precipitants.
- Morpheus® ligands promote initial crystal formation and lattice stability.
- Reduced crystal "stress" – all conditions are cryoprotected*.
- Easy optimization of 'hits'.
- Readily available Morpheus® Optimization reagents including the Mixes and Stock reagents.

Introduction

Morpheus® is a 96 condition protein crystallization screen with an original chemistry. It is based on extensive data mining of the PDB. The aim is to explore different chemical space than is achieved with conventional screening.

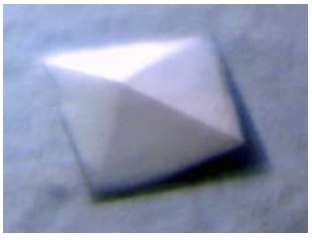
Morpheus® incorporates 49 low molecular weight components. They are PDB ligands sharing four main characteristics; they are small (the largest being HEPES MW 238.30 g/mol and the smallest a lithium ion MW 6.94 g/mol), stable, inexpensive and are associated with at least five unrelated PDB structures.

The selection of ligands is listed in Table 1 (data produced on the 14th of July 2008: 35759 structures with ligands in the PDB). Overall the PDB ligands in **Morpheus®** correspond with over 33,000 PDB structures. For instance, the two enantiomers of tartaric acid (PDB ID: TAR and TLA) are found ordered in 113 structures.

Preliminary tests with **Morpheus®** made within the Laboratory of Molecular Biology (LMB)[1] at Cambridge, UK, have shown encouraging results with various targets. In some cases, Morpheus® gave hits when all other commercial screens had failed.

Figure 1 shows examples of protein crystallization hits observed while testing **Morpheus®**.

All the conditions of **Morpheus®** are to some extent cryo-protected to minimize further mechanical stress on the crystals. For example, all PEG 4000 conditions contain a suitable amount of Glycerol.



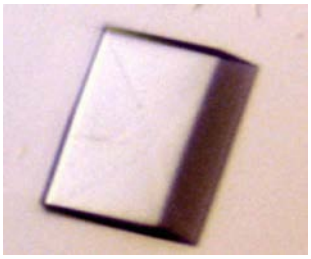


Figure 1. Examples of successful crystallization with Morpheus® (with the permission of Pobbati A., Low H. and Berndt A.)

Screen Design

Morpheus is based on a 3D grid design (Figure 2). Thirty of the top PDB ligands from Table 1 are grouped into eight mixes of additives depending on their chemical class (e.g. alcohols, carboxylic acids, etc) (Table 2).

These top PDB ligands also happen to be "biological buffers" like HEPES (PDB ID: EPE, 201 hits) and have been used to build three buffer systems[*]. Each buffer system includes different buffers with close pKa's (Table 3).

There are nine precipitants included in the composition of Morpheus. They are grouped into four mixes of precipitants (Table 4). The main characteristic of the four mixes is that they contain at least a PEG (Polyethylene glycol) and a different type of precipitant that is also a cryo-agent (e.g. Glycerol). All the conditions of Morpheus are cryo-protected to minimize further mechanical stress on the crystals.

Each mix of precipitants is systematically tested with all the mixes of additives and the mixes of buffers. The proportions of stocks are always the same for making any condition of the three-dimensional grid: 5:1:1:3 of precipitants, ligands, buffers and water respectively. When almost a third of the composition is water, there is space for making an optimization screen with higher concentration of any mix/component.

References

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

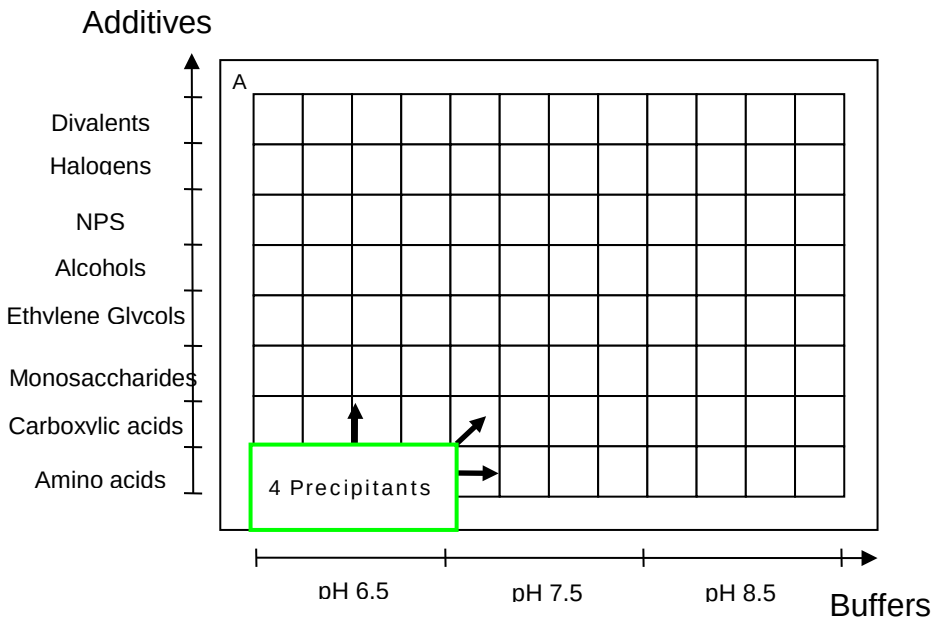


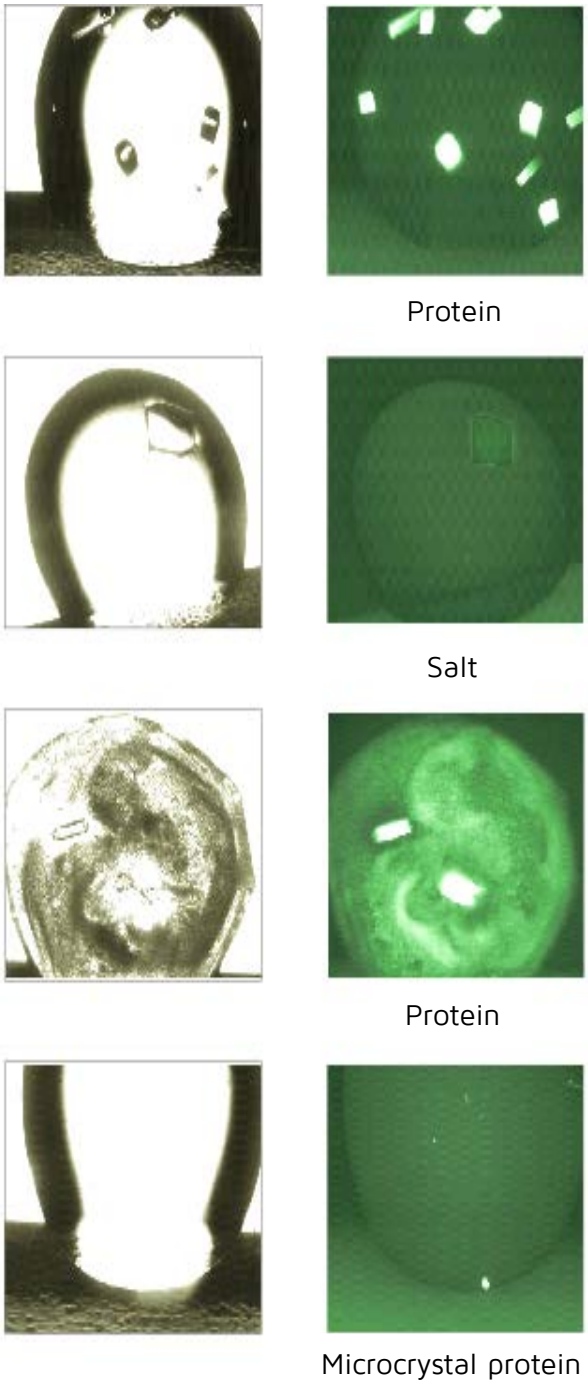
Figure 2. Schematic of Morpheus® – A three-dimensional grid screen

Green screen

Membrane and Soluble Proteins

Features of the Green Screens:

- **Non-covalent –** binds in channels and not observed to affect crystallization or diffraction quality in any of the proteins tested*.
- **Increased crystal contrast –** observe protein crystals <30 µM and also those lacking significant intrinsic fluorescence.
- **Improved signal-to-noise –** on average quantum yield ratio of fluorescence is increased from 0.2 to 0.7.
- **Easy-to-use –** available in three proven to be successful screens - PACT *premier*™, JCSG-*plus*™ and MemGold™.
- **Standard format –** for all automated systems – 1 mL HT-96 block (10 mL kits available on request).



Images kindly provided by Matthew Groves, EMBL Outstation – Hamburg.

Rationale behind Green Screens

In recent years UV fluorescence imaging has become an established method for protein/salt crystal discrimination. Whilst the majority of proteins contain at least one tryptophan residue there remain a number that fluoresce weakly or not at all, yielding a false negative. **Green Screens** contain a non-covalent fluorescent dye which conveys fluorescence on most proteins when illuminated with UV light. This not only increases the signal-to-noise ratio (important for very small crystals), but also allows the identification of protein crystals lacking intrinsic fluorescence that would otherwise remain ambiguous. Green screens are available in three of our most successful screens, **PACT *premier*™**, **JCSG-*plus*™** and **MemGold**™. Use these screens together with UV transparent plates (MD11-00U-100) and ClearVue sheets (MD6-01S) for optimum UV performance.

Reference:

Groves et al (2007). A method for the general identification of protein crystals in crystallization experiments using a non-covalent fluorescent dye. *Acta Cryst*. **D63**, 526-535.

Formulation Notes

Morpheus® reagents are formulated using ultrapure water (>18.0 MΩ) and are sterile-filtered using 0.22 µm filters. No preservatives are added.

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 Morpheus® 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

Manufacturer's safety data sheets are available from our website or by scanning the QR code here:

Morpheus Optimization

Although the screen is composed of various mixes, consider each condition as for any other screen, with three stock solutions:

- mix of precipitants
- mix of additives
- mix of buffers.

When you have more than one hit, you can deduce the importance of each stock from the beginning: e.g. Do I see specificity related to one stock? To pH?

Every condition can be made following the same ratio of stock solutions:

1/2 [Precipitant mix] + 1/10 [additive mix] + 1/10 [Buffer system] + 3/10 dH_2O.

To vary the pH, you can change the ratio of the two buffers within the buffer stock (i.e. change ratio of two non-titrated 1M buffer stocks).
Once you know more about the chemical space within Morpheus you can eventually investigate further, trying to reveal specificity of a single chemical.
For example, what happens when you replace the group of chemicals from a stock with only one chemical of this mix? (e.g. only one divalent cations instead of the corresponding mix of additives).

At this stage you may (or not) have a simpler condition to work with. You can also proceed to other "classic" optimization approaches such as using an additive screen, scale-up or seeding.

Table 1: List of PDB ligands in Morpheus®

PDB Ligand name(s)	Class	PDB ID(s)	Number of Structures*
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
Glutamic acid (enantiomers L and D)	Precipitant	GLU, DGL	75
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
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
		SUM	32956

*As determined by querying the PDB in July 2008

Table 2: Mixes of additives used in Morpheus®

Mix name	Composition	Catalogue Number (100 mL)	Catalogue Number (250 mL)
Divalents	0.3M Magnesium chloride hexahydrate; 0.3M Calcium chloride dihydrate	MD2-100-70	MD2-250-70
Halogens	0.3M Sodium fluoride; 0.3M Sodium bromide; 0.3M Sodium iodide	MD2-100-71	MD2-250-71
NPS†	0.3M Sodium nitrate, 0.3 Sodium phosphate dibasic, 0.3M Ammonium sulfate	MD2-100-72	MD2-250-72
Alcohols	0.2M 1,6-Hexanediol; 0.2M 1-Butanol 0.2M 1,2-Propanediol; 0.2M 2-Propanol; 0.2M 1,4-Butanediol; 0.2M 1,3-Propanediol	MD2-100-73	MD2-250-73
Ethylene glycols	0.3M Diethylene glycol; 0.3M Triethylene glycol; 0.3M Tetraethylene glycol; 0.3M Pentaethylene glycol	MD2-100-74	MD2-250-74
Monosaccharides	0.2M D-Glucose; 0.2M D-Mannose; 0.2M D-Galactose; 0.2M L-Fucose; 0.2M D-Xylose; 0.2M N-Acetyl-D-Glucosamine	MD2-100-75	MD2-250-75
Carboxylic acids	0.2M Sodium formate; 0.2M Ammonium acetate; 0.2M Sodium citrate tribasic dihydrate; 0.2M Potassium sodium tartrate tetrahydrate; 0.2M Sodium oxamate	MD2-100-76	MD2-250-76
Amino acids	0.2M DL-Glutamic acid monohydrate; 0.2M DL-Alanine; 0.2M Glycine; 0.2M DL-Lysine monohydrochloride; 0.2M DL-Serine	MD2-100-77	MD2-250-77

†**NPS**; Nitrate Phosphate Sulfate

Table 3: Buffer systems used in Morpheus®

Mix name	Conc.	pH @ 20°C	Composition	Catalogue Number (100 mL)	Catalogue Number (250 mL)
Buffer System 1	1.0M	6.5	Imidazole; MES monohydrate (acid)	MD2-100-100	MD2-250-100
Buffer System 2	1.0M	7.5	Sodium HEPES; MOPS (acid)	MD2-100-101	MD2-250-101
Buffer System 3	1.0M	8.5	Tris (base); BICINE	MD2-100-102	MD2-250-102

Table 4: Mixes of Precipitants used in Morpheus®

Mix name	Old Mix Name	Composition	Catalogue Number (100 mL)	Catalogue Number (250 mL)
60% Precipitant Mix 1	P500MME_P20K	40% v/v PEG 500* MME; 20 % w/v PEG 20000	MD2-100-81	MD2-250-81
60% Precipitant Mix 2	EDO_P8K	40% v/v Ethylene glycol; 20 % w/v PEG 8000	MD2-100-82	MD2-250-82
60% Precipitant Mix 3	GOL_P4K	40% v/v Glycerol; 20% w/v PEG 4000	MD2-100-83	MD2-250-83
75% Precipitant Mix 4	MPD_P1K_P3350	25% v/v MPD; 25% PEG 1000; 25% w/v PEG 3350	MD2-100-84	MD2-250-84

*The PEG 550 MME that was originally used in this screen has been discontinued and replaced with PEG 500 MME.

Manufacturer's safety data sheets are available from our website.

Molecular Dimensions

ACHIEVE MORE.

Green screen

Membrane and Soluble Proteins

RE-ORDERING INFORMATION

Code	Pack Size	Description
MD1-46	96 x 10 mL	Morpheus
MD1-47	96 x 1 mL	Morpheus HT-96
MD1-47-FX	96x 100 µL	Morpheus FX-96 pre-filled plate
Other Morpheus screens		
MD1-91	96 x 10 mL	Morpheus II
MD1-92	96 x 1 mL	Morpheus II HT-96
MD1-92-FX	96x 100 µL	Morpheus II FX-96 pre-filled plate
MD1-93	48 x 100 µL	The Morpheus® Additive screen
MD1-116	96 x 10 mL	Morpheus III
MD1-117	96 x 1 mL	Morpheus III HT-96
MD1-118	48 x 100 µL	Hippocrates™ additive screen
Green screens (contain green fluorescent dye – ideal for UV)		
MD1-46-GREEN	96 x 10 mL	Morpheus Green screen
MD1-47-GREEN	96 x 1 mL	Morpheus HT-96 Green screen
Combo Packs		
MD1-76	192 x 10 mL	Power combo value pack (Morpheus + MIDASplus)
MD1-76-HT	192 x 1 mL	Power combo value pack HT-96 (Morpheus + MIDASplus HT-96)
Single reagents		
MDSR-46-tube number	100 mL	Morpheus single reagents
MDSR-47-well number	100 mL	Morpheus HT-96 single reagents

Try our newest screen Morpheus® III MD1-116 (10 mL) and MD1-117 (HT-96) for even more success with your crystallisations

Morpheus, Morpheus II and Morpheus III have 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 from LifeARC by Molecular Dimensions Limited.

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Well #	Conc		Ligands	Conc		Buffer	pH	Conc		Precipitant	Dye concentration
A1	0.1	M	Divalents	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
A2	0.1	M	Divalents	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
A3	0.1	M	Divalents	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
A4	0.1	M	Divalents	0.1	M	Buffer System 1	7	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
A5	0.1	M	Divalents	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
A6	0.1	M	Divalents	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
A7	0.1	M	Divalents	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
A8	0.1	M	Divalents	0.1	M	Buffer System 2	8	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
A9	0.1	M	Divalents	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
A10	0.1	M	Divalents	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
A11	0.1	M	Divalents	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
A12	0.1	M	Divalents	0.1	M	Buffer System 3	9	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
B1	0.1	M	Halogens	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
B2	0.1	M	Halogens	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
B3	0.1	M	Halogens	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
B4	0.1	M	Halogens	0.1	M	Buffer System 1	7	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
B5	0.1	M	Halogens	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
B6	0.1	M	Halogens	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
B7	0.1	M	Halogens	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
B8	0.1	M	Halogens	0.1	M	Buffer System 2	8	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
B9	0.1	M	Halogens	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
B10	0.1	M	Halogens	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
B11	0.1	M	Halogens	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
B12	0.1	M	Halogens	0.1	M	Buffer System 3	9	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
C1	0.1	M	NPS	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
C2	0.1	M	NPS	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
C3	0.1	M	NPS	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
C4	0.1	M	NPS	0.1	M	Buffer System 1	7	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
C5	0.1	M	NPS	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
C6	0.1	M	NPS	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
C7	0.1	M	NPS	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
C8	0.1	M	NPS	0.1	M	Buffer System 2	8	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
C9	0.1	M	NPS	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
C10	0.1	M	NPS	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
C11	0.1	M	NPS	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
C12	0.1	M	NPS	0.1	M	Buffer System 3	9	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
D1	0.1	M	Alcohols	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
D2	0.1	M	Alcohols	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
D3	0.1	M	Alcohols	0.1	M	Buffer System 1	7	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
D4	0.1	M	Alcohols	0.1	M	Buffer System 1	7	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
D5	0.1	M	Alcohols	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
D6	0.1	M	Alcohols	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
D7	0.1	M	Alcohols	0.1	M	Buffer System 2	8	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
D8	0.1	M	Alcohols	0.1	M	Buffer System 2	8	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS
D9	0.1	M	Alcohols	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 1	100µM 1,8-ANS
D10	0.1	M	Alcohols	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 2	100µM 1,8-ANS
D11	0.1	M	Alcohols	0.1	M	Buffer System 3	9	30	% v/v	Precipitant Mix 3	100µM 1,8-ANS
D12	0.1	M	Alcohols	0.1	M	Buffer System 3	9	37.5	% v/v	Precipitant Mix 4	100µM 1,8-ANS

Tube	Well	Conc	Ligands	Conc	Buffer	pH	Conc	Precipitant
2-1	E1	0.12 M	Ethylene glycols	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 1
2-2	E2	0.12 M	Ethylene glycols	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 2
2-3	E3	0.12 M	Ethylene glycols	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 3
2-4	E4	0.12 M	Ethylene glycols	0.1 M	Buffer System 1	6.5	37.5 % v/v	Precipitant Mix 4
2-5	E5	0.12 M	Ethylene glycols	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 1
2-6	E6	0.12 M	Ethylene glycols	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 2
2-7	E7	0.12 M	Ethylene glycols	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 3
2-8	E8	0.12 M	Ethylene glycols	0.1 M	Buffer System 2	7.5	37.5 % v/v	Precipitant Mix 4
2-9	E9	0.12 M	Ethylene glycols	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 1
2-10	E10	0.12 M	Ethylene glycols	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 2
2-11	E11	0.12 M	Ethylene glycols	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 3
2-12	E12	0.12 M	Ethylene glycols	0.1 M	Buffer System 3	8.5	37.5 % v/v	Precipitant Mix 4
2-13	F1	0.12 M	Monosaccharides	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 1
2-14	F2	0.12 M	Monosaccharides	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 2
2-15	F3	0.12 M	Monosaccharides	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 3
2-16	F4	0.12 M	Monosaccharides	0.1 M	Buffer System 1	6.5	37.5 % v/v	Precipitant Mix 4
2-17	F5	0.12 M	Monosaccharides	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 1
2-18	F6	0.12 M	Monosaccharides	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 2
2-19	F7	0.12 M	Monosaccharides	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 3
2-20	F8	0.12 M	Monosaccharides	0.1 M	Buffer System 2	7.5	37.5 % v/v	Precipitant Mix 4
2-21	F9	0.12 M	Monosaccharides	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 1
2-22	F10	0.12 M	Monosaccharides	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 2
2-23	F11	0.12 M	Monosaccharides	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 3
2-24	F12	0.12 M	Monosaccharides	0.1 M	Buffer System 3	8.5	37.5 % v/v	Precipitant Mix 4
2-25	G1	0.1 M	Carboxylic acids	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 1
2-26	G2	0.1 M	Carboxylic acids	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 2
2-27	G3	0.1 M	Carboxylic acids	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 3
2-28	G4	0.1 M	Carboxylic acids	0.1 M	Buffer System 1	6.5	37.5 % v/v	Precipitant Mix 4
2-29	G5	0.1 M	Carboxylic acids	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 1
2-30	G6	0.1 M	Carboxylic acids	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 2
2-31	G7	0.1 M	Carboxylic acids	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 3
2-32	G8	0.1 M	Carboxylic acids	0.1 M	Buffer System 2	7.5	37.5 % v/v	Precipitant Mix 4
2-33	G9	0.1 M	Carboxylic acids	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 1
2-34	G10	0.1 M	Carboxylic acids	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 2
2-35	G11	0.1 M	Carboxylic acids	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 3
2-36	G12	0.1 M	Carboxylic acids	0.1 M	Buffer System 3	8.5	37.5 % v/v	Precipitant Mix 4
2-37	H1	0.1 M	Amino acids	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 1
2-38	H2	0.1 M	Amino acids	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 2
2-39	H3	0.1 M	Amino acids	0.1 M	Buffer System 1	6.5	30 % v/v	Precipitant Mix 3
2-40	H4	0.1 M	Amino acids	0.1 M	Buffer System 1	6.5	37.5 % v/v	Precipitant Mix 4
2-41	H5	0.1 M	Amino acids	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 1
2-42	H6	0.1 M	Amino acids	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 2
2-43	H7	0.1 M	Amino acids	0.1 M	Buffer System 2	7.5	30 % v/v	Precipitant Mix 3
2-44	H8	0.1 M	Amino acids	0.1 M	Buffer System 2	7.5	37.5 % v/v	Precipitant Mix 4
2-45	H9	0.1 M	Amino acids	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 1
2-46	H10	0.1 M	Amino acids	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 2
2-47	H11	0.1 M	Amino acids	0.1 M	Buffer System 3	8.5	30 % v/v	Precipitant Mix 3
2-48	H12	0.1 M	Amino acids	0.1 M	Buffer System 3	8.5	37.5 % v/v	Precipitant Mix 4