Membrane Protein Crystallization

Larry DeLucas
Introduction 1

CHAPTER 1  Introduction to the Crystallization of Biological Macromolecules  
Alex McPherson

I. Overview 5  
II. Introduction 6  
III. The Requirement for Supersaturation 6  
References 22

CHAPTER 2  In Vitro Synthesis of Posttranslationally Modified Membrane Proteins  
Stefan Kubick, Michael Gerrits, Helmut Merk, Wolfgang Stiege, and Volker A. Erdmann

I. Overview 25  
II. Introduction 26  
III. Materials and Methods 29  
IV. Results 30  
V. Conclusions 46  
References 47

CHAPTER 3  Harnessing Photosynthetic Bacteria for Membrane Protein Production  
Deborah K. Hanson, Donna L. Mielke, and Philip D. Laible

I. Overview 52  
II. Introduction 52  
III. Foreign Gene Expression in Rhodobacter sphaeroides 57
CHAPTER 4  Monoacylglycerols: The Workhorse Lipids for Crystallizing Membrane Proteins in Mesophases
M. Caffrey, J. Lyons, T. Smyth, and D. J. Hart

I. Overview 83
II. Introduction 84
III. In Meso Crystallogenesis in Molecular Detail 86
IV. Mesophase Behavior: From Lamellar to Cubic and Sponge Phases 87
V. A Central Role for Lipid 91
VI. Lipid Synthesis and Purification 95
VII. Conclusions 105
References 106

CHAPTER 5  Practical Aspects of Membrane Proteins Crystallization in Bicelles
Salem Faham, Rachna Ujwal, Jeff Abramson, and James U. Bowie

I. Overview 109
II. Introduction 110
III. Bicelles 112
IV. Phase Behavior of Bicelles 113
V. Examples of Membrane Proteins Crystallized in Bicelles 114
VI. Crystal Packing 118
VII. Practical Information 118
VIII. Conclusion 122
References 123

CHAPTER 6  Membrane Protein Crystallization: Approaching the Problem and Understanding the Solutions
Mads Gabrielsen, Alastair T. Gardiner, Petra Fromme, and Richard J. Cogdell

I. Overview 128
II. Introduction 128
CHAPTER 7 Tools to Enhance Membrane Protein Crystallization
W. William Wilson, Gregg Whited, Robert W. Payne, Charles Henry, David H. Johnson, and Larry DeLucas

I. Overview 152
II. Introduction 152
III. Protein-Protein Interactions and Crystallization 153
IV. Self-Interaction Chromatography 156
V. Validation Studies: SIC Accurately Quantifies B 158
References 175

CHAPTER 8 Advances in Microfluidic Membrane Protein Crystallization Techniques
Cory Gerdts and Peter Nollert

I. Overview 179
II. Membrane Protein Crystallization 180
III. Microfluidics 180
IV. Crystallization by FID in Polydimethylsiloxane (PDMS) Devices 182
V. Membrane Protein Crystallization in Gradients Established in Microchannels 184
VI. Plug-Based Membrane Protein Crystallization in Microcapillaries 185
VII. Conclusion 187
References 189
CHAPTER 9  Crystallization of Photosynthetic Membrane Proteins
Petra Fromme and Ingo Grotjohann

I. Overview 192
II. Overview of Crystallization of Photosynthetic Membrane Proteins 192
III. Biological Parameters that Influence Crystallization 196
IV. Physical-Chemical Parameters that Influence Crystallization 202
V. Crystallization Techniques 209
VI. Determination of Phase Diagrams 216
VII. Seeding Techniques 221
References 224

Mikio Tanabe and Tina M. Iverson

I. Overview 230
II. Introduction 230
III. Expression and Purification 232
IV. Preliminary Crystallization and Diffraction-Based Optimization 252
V. Materials and Methods 262
References 263

CHAPTER 11  Bacterial Membrane Proteins: The New Soluble Proteins?
Hubing Lou, Konstantinos Beis, and James H. Naismith

I. Overview 269
II. Structures of Omps 270
III. Recombinant Production of Omps 284
IV. Recombinant Bacterial Inner Membrane Proteins and Eukaryotic Membrane Proteins 286
V. Crystallization of Membrane Proteins 287
VI. New Strategies for Eukaryotic Proteins from the Study of GPCR 288
VII. Summary 291
References 292

Index 299