

Contents

1	Introduction	1
	References	3
2	The Role of Fragmentation on the Formation of Homomeric Protein Complexes	5
2.1	Introduction	5
2.2	Homomeric Protein Complexes	6
2.2.1	Homomeric Membrane Proteins	8
2.2.2	Interactions Responsible for the Formation of Quaternary Structures	9
2.2.3	Diffusion Coefficient of Membrane Proteins	10
2.3	The First Passage Time Processes: An Estimation of the Aggregation Time Scale	11
2.3.1	The First Passage Time on a Sphere	12
2.4	The Smoluchowski Coagulation Equation	13
2.4.1	System with Fragmentation	15
2.5	The Efficiency of Formation of Protein Complexes	16
2.5.1	Steady State Size Distribution with Irreversible Dynamics	18
2.5.2	Role of the Fragmentation	20
2.6	Discussion	28
	References	29
3	Collective Response of Self-Organised Clusters of Mechanosensitive Channels	31
3.1	Introduction	31
3.2	Mechanosensitive Channels	32
3.2.1	Prokaryotic Mechanosensitive Channels	33
3.2.2	Eukaryotic Mechanosensitive Channels	35

3.3	Experimental Techniques Employed in the Study of Mechanosensitive Channels	36
3.3.1	Measurement of the Channel Gating and Sensitivity to Tension	37
3.3.2	Spatial Localization of Mechanosensitive Channels	38
3.4	Evidences of Clustering of Mechanosensitive Channels	39
3.5	Individual Channel Gating	39
3.6	Interactions Between Membrane Inclusions	40
3.6.1	Direct Protein–Protein Interactions	41
3.6.2	Membrane-Mediated Protein–Protein Interactions	42
3.7	Model of the Cooperative Gating of the Mechanosensitive Channels	46
3.8	Dynamics of Agglomeration	47
3.8.1	The Lattice Gas Phase Diagram	49
3.8.2	Conditions for Mechanosensitive Channel Agglomeration	51
3.9	Dynamics of Gating	51
3.9.1	Equilibrium Properties	54
3.9.2	Dynamics of Escape From the Metastable State	59
3.9.3	The Transition From Closed to Open Conformations . . .	59
3.9.4	The Transition From Open to Closed Conformations . . .	61
3.9.5	Classical Nucleation Theory and the Delay of the Channel Response	62
3.10	Discussion	64
	References	65
4	Assembly and Fragmentation of Tat Pores	69
4.1	Introduction	69
4.2	Tat Protein Transport System	69
4.3	The Theory of TatA Assembly Process	71
4.3.1	The Assembly of a Single Ring	72
4.4	Assembly of Multiple Rings	73
4.4.1	Translocation of Only One Type of Protein	74
4.4.2	Translocation of Protein of Distinct Sizes	74
4.4.3	Condition for the Existence of a Steady State	76
4.5	Discussion	77
	References	78
5	Conclusion	79