

Contents

1	The Biological Significance of “Nano”-interactions	1
1.1	Nanoscience in Medicine	1
1.2	Nanotechnology and Medical Applications	3
1.2.1	Implantable Biosensors	3
1.2.2	Nanosurgery	4
1.2.3	Tissue Engineering	5
1.2.4	Nanoparticle-Enabled Diagnostics	6
1.2.5	Targeted Drug Delivery	7
1.3	Bridging Nanoscience and Nanomedicine	7
1.4	The Nanoparticle Interface	8
1.4.1	Interaction of Nanoparticles with Environmental Biomolecules	8
1.4.2	Biological Response to Nanomaterials	13
1.5	Cytotoxicity	14
1.6	Conclusion	16
	References	17
2	Nanoparticle and Protein Corona	21
2.1	Structure and Composition of Corona	22
2.1.1	Hard Corona	23
2.1.2	Soft Corona	25
2.2	Protein Conformation	25
2.3	Dynamic of Protein Corona and Its Time Evolution	26
2.3.1	Early Stage	27
2.3.2	Late Stage	27
2.4	Parameters Affecting Protein Corona	29
2.4.1	Surface Charge of Nanoparticle	30
2.4.2	Nanoparticle Material	30
2.4.3	Surface Functionalization and Coatings	30

2.4.4	Hydrophilicity/Hydrophobicity	31
2.4.5	Nanoparticle Size	32
2.4.6	Biological Environment	33
2.5	Ignored Issues of Protein Corona	35
2.5.1	Temperature	35
2.5.2	Gradient Plasma	39
2.6	Conclusion	42
	References	42
3	Protein Corona: Applications and Challenges	45
3.1	What Cells See of Nanoparticles	46
3.2	NPs Circulation Inside the Body	49
3.3	Targeting	53
3.4	Toxicity	55
3.5	Protein Denature or Fibrillation	56
3.6	Problems of Protein Corona	57
3.7	Conclusion	60
	References	61
4	Analytical Methods for Corona Evaluations	65
4.1	Centrifugation	68
4.2	Circular Dichroism	69
4.3	Isothermal Titration Calorimetry	70
4.4	SDS-PAGE	72
4.4.1	Capillary Electrophoresis	72
4.4.2	One-Dimensional Gel Electrophoresis	72
4.4.3	Two-Dimensional Gel Electrophoresis	72
4.5	UV-Visible Spectroscopy	75
4.6	Fluorescence Spectroscopy	76
4.7	Mass Spectrometry	77
4.8	Fourier Transform Infrared and Raman Spectroscopies	78
4.9	NMR	79
4.10	X-Ray	79
4.11	Differential Centrifugation Sedimentation	79
	References	80
	Index	83