****

**TABLE OF CONTENTS**

[1. REPORT OVERVIEW 16](#_Toc96950013)

[1.1 Statement of the Report…………………………………………………………………………17](#_Toc96950014)

[1.2 Target Demographic……………………………………………………………………………..18](#_Toc96950015)

[1.3 Report Sources …………………………………………………………………………………..18](#_Toc96950016)

[1.4 Purpose of the Report……………………………………………………………………………19](#_Toc96950017)

[1.5 Executive Summary………………………………………………………………………………20](#_Toc96950018)

[1.6 Introduction………………………………………………………………………………………..21](#_Toc96950019)

[2. EXOSOMES: AN OVERVIEW 22](#_Toc96950020)

[2.1 Structure of an Exosome 24](#_Toc96950021)

[2.1.1 Molecular Contents of Exosomes 25](#_Toc96950022)

[2.1.1.1 Proteins in Exosomes 26](#_Toc96950023)

[2.1.1.2 Lipid Contents of Exosomes 27](#_Toc96950024)

[2.1.1.3 Nucleic Acids in Exosomes 28](#_Toc96950025)

[2.1.2 Components of Membrane and Lumen of Exosomes 28](#_Toc96950026)

[2.2 Classification of Exosomes 29](#_Toc96950027)

[2.2.1 Natural Exosomes 30](#_Toc96950028)

[2.2.1.1 Isolation of Natural Exosomes 30](#_Toc96950029)

[2.2.2 Modified Exosomes 31](#_Toc96950030)

[2.2.2.1 Types of Therapeutic Cargo used in Exosome Modifications 32](#_Toc96950031)

[2.2.3 Synthetic Exosomes 33](#_Toc96950032)

[2.3 Biomedical Applications of Engineered Exosomes 33](#_Toc96950033)

[2.4 Functions of Exosomes 34](#_Toc96950034)

[2.4.1 Pivotal Role of Exosomes 34](#_Toc96950035)

[2.4.2 Adaptability to Engineering 34](#_Toc96950036)

[2.5 Differences between Exosome Therapy and Cell Therapy 35](#_Toc96950037)

[2.6 Sources of Exosomes for Research 36](#_Toc96950038)

[2.7 Leveraging Exosomes as Biomarkers 37](#_Toc96950039)

[2.8 The Shift from Cell Therapy to Exosome Therapy 38](#_Toc96950040)

[3. EXOSOME ENGINEERING: THE NEW PLATFORM 40](#_Toc96950041)

[3.1 Interior Modification 40](#_Toc96950042)

[3.1.1 Pre-Isolation Interior Modification Methods 40](#_Toc96950043)

[3.1.1.1 Incubation 40](#_Toc96950044)

[3.1.1.2 Gene Editing 41](#_Toc96950045)

[3.1.2 Post-Isolation Interior Modification Methods 41](#_Toc96950046)

[3.2 Surface Modifications 42](#_Toc96950047)

[3.2.1 Surface Modification through Parent Cells 43](#_Toc96950048)

[3.2.2 Direct Surface Modification 43](#_Toc96950049)

[3.2.3 Loaded and Displayed Molecules in Direct Exosome Engineering 44](#_Toc96950050)

[3.3 Comparison of Modification Methods 45](#_Toc96950051)

[3.4 Clinical Applications of Designer Exosomes 47](#_Toc96950052)

[3.4.1 Targeted Designer Exosomes 47](#_Toc96950053)

[3.4.2 Anti-Cancer Designer Exosomes 48](#_Toc96950054)

[3.4.3 Regenerative Designer Exosomes 48](#_Toc96950055)

[3.5 Companies Developing Engineered Exosome-Based Therapeutics 49](#_Toc96950056)

[4. MSC-DERIVED EXOSOMES IN REGENERATIVE MEDICINE 50](#_Toc96950057)

[4.1 Cardiovascular Diseases 51](#_Toc96950058)

[4.2 Kidney Diseases 52](#_Toc96950059)

[4.3 Liver Diseases 53](#_Toc96950060)

[4.4 Wound Healing 54](#_Toc96950061)

[4.5 MSC Exosome-Based Clinical Trials for Regenerative Medicines 55](#_Toc96950062)

[5. EXOSOME RESEARCH 56](#_Toc96950063)

[5.1 Research to Inhibit Disease-Derived Exosomes 56](#_Toc96950064)

[5.1.1 Research to use Exosomes as Therapeutic Platforms 56](#_Toc96950065)

[5.1.2 Research to use Exosomes as Carriers of Genes in Gene Therapy 57](#_Toc96950066)

[5.1.3 Research to use Exosomes as Drug Delivery Vehicles 57](#_Toc96950067)

[5.1.4 Research to Develop Technologies for Exosome Isolation 57](#_Toc96950068)

[5.2 Common Isolation Methods in Exosome Research 58](#_Toc96950069)

[5.3 Quality Control (QC) of Exosomes in Exosome Research 58](#_Toc96950070)

[5.4 Bioimaging Modalities used in Exosome Research 59](#_Toc96950071)

[5.5 Labeling Methods used in Exosome Research 60](#_Toc96950072)

[5.5.1 Fluorescent Dyes used in Labeling Exosomes 62](#_Toc96950073)

[5.5.2 Common Methods to Remove Unlabelled Probes 63](#_Toc96950074)

[5.6 Determination of Exosome Dose in Exosome Studies 64](#_Toc96950075)

[5.7 Routes of Exosome Administration 64](#_Toc96950076)

[5.8 Characterization of Exosomes in Research 65](#_Toc96950077)

[6. COMMERCIALLY AVAILABLE EXOSOME RESEARCH TOOLS 66](#_Toc96950078)

[6.1 Exosome Capture/Quantification Kits 66](#_Toc96950079)

[6.1.1 Exosome-associated RNA Isolation Kits 67](#_Toc96950080)

[6.2 Exosome Standards 68](#_Toc96950081)

[6.3 Immunoplates for Capturing Exosomes 68](#_Toc96950082)

[6.4 Immunobeads for Exosome Isolation 69](#_Toc96950083)

[6.5 Exosome Marker Antibodies 69](#_Toc96950084)

[7. SCIENTIFIC PUBLICATIONS IN EXOSOMES 70](#_Toc96950085)

[7.1 Trends in Global Publications 70](#_Toc96950086)

[7.1.1 PubMed Publications on Exosome DNA as Diagnostics 71](#_Toc96950087)

[7.1.2 Number of PubMed Publications on Exosome RNA as Diagnostics 72](#_Toc96950088)

[7.1.3 PubMed Publications on Exosome Proteins as Diagnostics 73](#_Toc96950089)

[7.1.4 PubMed Publications on Exosomes Derived from Stem Cells 74](#_Toc96950090)

[7.1.5 PubMed Publications on Exosome-based Diagnostics 75](#_Toc96950091)

[7.1.6 PubMed Publications on Exosome-based Therapeutics 76](#_Toc96950092)

[7.1.7 PubMed Publications on Exosomes for Cancer Diagnosis 77](#_Toc96950093)

[7.1.8 PubMed Publications on Exosomes for Pregnancy Disorders Diagnosis 78](#_Toc96950094)

[7.2 Future in Exosome Research Publications 79](#_Toc96950095)

[8. EXOSOME PATENT LANDSCAPE 80](#_Toc96950096)

[8.1 A Brief Overview of Current Exosome Patent Landscape 80](#_Toc96950097)

[8.1.1 Patents/Patent Applications Relevant to Exosome-Sources 81](#_Toc96950098)

[8.1.2 Patents/Applications Related to Exosomes-Isolation/Preparation 81](#_Toc96950099)

[8.1.3 Patents/Applications Related to Type of Cargo 82](#_Toc96950100)

[8.1.4 Patents/Applications Related to Cargo Loading Methods 83](#_Toc96950101)

[8.1.5 Patents/Applications Related to Therapy Area 83](#_Toc96950102)

[8.2 Leading Assignees of Exosome Patents 84](#_Toc96950103)

[8.2.1 Types of Patented Isolation/Preparation Technologies by Assignees 85](#_Toc96950104)

[8.2.2 Types of Cargos Employed by Assignees 86](#_Toc96950105)

[8.2.3 Cargo Loading Methods by Assignees 87](#_Toc96950106)

[8.2.4 Therapy Areas by Assignees 88](#_Toc96950107)

[8.3 Exosome Patent/Patent Applications by Geography 89](#_Toc96950108)

[8.4 Legal Status of Exosome Patent/Patent Applications 89](#_Toc96950109)

[8.5 Assignee Categories 90](#_Toc96950110)

[9. EXOSOMES: CLINICAL TRIAL LANDSCAPE 91](#_Toc96950111)

[9.1 Sources of Exosomes used in Clinical Trials 92](#_Toc96950112)

[9.2 Studies using Anti-Tumor Antigens 92](#_Toc96950113)

[9.3 Studies using Cytotoxic Drugs against Cancer 92](#_Toc96950114)

[9.4 Recruitment Status of Ongoing Exosome-based Clinical Trials 93](#_Toc96950115)

[9.5 Study Designs 93](#_Toc96950116)

[9.6 Study Phases 94](#_Toc96950117)

[9.7 Funding Types 95](#_Toc96950118)

[9.8 Exosome Clinical Trials by Geography 96](#_Toc96950119)

[9.9 Clinical Trials Involving MSC-Derived Exosomes 96](#_Toc96950120)

[9.10 Examples of Clinical Trials involving Drug-Loaded Exosomes 97](#_Toc96950121)

[10. CURRENT STATUS OF EXOSOME MANUFACTURING 99](#_Toc96950122)

[10.1 Production of Exosomes from Cell Cultures 99](#_Toc96950123)

[10.2 Production Formats 100](#_Toc96950124)

[10.2.1 Large Scale Production 100](#_Toc96950125)

[10.2.1.1 Upstream Cell Line Production 101](#_Toc96950126)

[10.2.1.2 Downstream Exosome Purification Methods 102](#_Toc96950127)

[10.3 Companies Offering Exosome-Related Services 103](#_Toc96950128)

[11. EXOSOME ISOLATION APPROACHES 105](#_Toc96950129)

[11.1 Differential Ultracentrifugation 105](#_Toc96950130)

[11.1.1 Gradient Density Ultracentrifugation 106](#_Toc96950131)

[11.2 Ultrafiltration & Sequential Ultrafiltration 107](#_Toc96950132)

[11.3 Size-exclusion Chromatography 107](#_Toc96950133)

[11.4 Polymer Precipitation 108](#_Toc96950134)

[11.5 Immunoaffinity Capture 109](#_Toc96950135)

[11.6 Microfluidics-Based Techniques 109](#_Toc96950136)

[11.6.1 Active and Passive Methods of Microfluidics-based Platforms 110](#_Toc96950137)

[11.7 Commercially Available Exosome Isolation Kits 112](#_Toc96950138)

[11.7.1 Comparison of Currently used Exosome Isolation Techniques 113](#_Toc96950139)

[11.7.2 Quality of Exosomes Isolated by Different Methods 114](#_Toc96950140)

[11.8 Summary of Different Exosome Isolation Methods 114](#_Toc96950141)

[11.9 Characterization of Exosomes 116](#_Toc96950142)

[11.9.1 Size and Shape 116](#_Toc96950143)

[11.9.2 Molecular Profiling 116](#_Toc96950144)

[11.9.3 Proteomics and Lipidomics 116](#_Toc96950145)

[11.9.4 Genomics 117](#_Toc96950146)

[11.10 Microscopy and Nanoscopy for Exosome Imaging 117](#_Toc96950147)

[11.11 Direct Post-Isolation Labeling for Imaging 117](#_Toc96950148)

[11.12 Approaches for Exosome Analysis for Gene and Protein Biomarkers 117](#_Toc96950149)

[11.13 Emerging Optical Technologies for Exosome Analysis 118](#_Toc96950150)

[11.14 Emerging Electrochemical and Electromechanical Approaches 122](#_Toc96950151)

[12. DIAGNOSTIC APPLICATIONS OF EXOSOMES 124](#_Toc96950152)

[12.1.1 Exosomal Proteins as Diagnostic Biomarkers 125](#_Toc96950153)

[11.1.2 Exosomal Nucleic Acids as Biomarkers 128](#_Toc96950154)

[12.1.3 Non-Coding RNAs in Exosomes as Biomarkers in Cancers 133](#_Toc96950155)

[12.1.3.1 Exosomes from other Biofluids as Biomarkers for Cancer 134](#_Toc96950156)

[12.2 Exosome Biomarkers in Pregnancy Disorders 135](#_Toc96950157)

[12.3 Exosome Biomarkers and Early Diagnosis of Immunologic Rejection 137](#_Toc96950158)

[12.4 Number of PubMed Articles on Exosome-Based Diagnosis 138](#_Toc96950159)

[12.5 Clinical Trials involving Exosome-based Diagnostics 139](#_Toc96950160)

[13. THERAPEUTC APPLICATIONS OF EXOSOMES 140](#_Toc96950161)

[13.1 Advantages of Exosomes as Therapeutics 142](#_Toc96950162)

[13.2 Therapeutic Exosome Platforms 142](#_Toc96950163)

[13.2.1 Naïve Exosome Therapeutics 142](#_Toc96950164)

[13.2.2 Engineered Exosome Therapeutics 143](#_Toc96950165)

[13.2.2.1 Passive Cargo Loading 143](#_Toc96950166)

[13.2.2.2 Active Cargo Loading 144](#_Toc96950167)

[13.3 Drugs Encapsulated in Exosomes 147](#_Toc96950168)

[13.4 Preclinical Studies involving Loaded Exosome Therapeutics 149](#_Toc96950169)

[13.5 Clinical Trials involving Exosome Therapeutics 150](#_Toc96950170)

[14. APPLICATION OF EXOSOMES IN VACCINE DEVELOPMENT 151](#_Toc96950171)

[14.1 Exosome-Based Immunotherapy in Animal Models 151](#_Toc96950172)

[14.2 Ongoing Clinical Trials Involving Exosomes in Developing Vaccines 152](#_Toc96950173)

[15. CURRENT STATUS OF EXOSOME INDUSTRY 153](#_Toc96950174)

[15.1 The Shift from Cell Therapy to Exosome Therapy 153](#_Toc96950175)

[15.2 Clinical Applications of Exosomes 154](#_Toc96950176)

[15.2.1 Diagnostic Applications 155](#_Toc96950177)

[5.2.2 Approved Exosome Diagnostics 156](#_Toc96950178)

[15.2.2.1 ExoDx Prostate IntelliScore (EPI) Test 156](#_Toc96950179)

[15.2.2.2 Guardant360 CDx 156](#_Toc96950180)

[15.3 Clinical Trials Focusing on Exosome-Based Diagnostics 157](#_Toc96950181)

[15.4 Therapeutic Applications of Exosomes 158](#_Toc96950182)

[15.4.1 Promising Exosome-Based Therapeutic Candidates 159](#_Toc96950183)

[15.4.1.1 AB 126 159](#_Toc96950184)

[15.4.1.2 AGLE-102 160](#_Toc96950185)

[15.4.1.3 AVA-201 160](#_Toc96950186)

[15.4.1.4 AVA-202 160](#_Toc96950187)

[15.4.1.5 AZ001 160](#_Toc96950188)

[15.4.1.6 CAP-2003 161](#_Toc96950189)

[15.4.1.7 exoIL-12 161](#_Toc96950190)

[15.4.1.8 ExoPr0 161](#_Toc96950191)

[15.4.1.9 exoSTING 162](#_Toc96950192)

[15.4.1.10 Plexaris 162](#_Toc96950193)

[15.4.1.11 UNEX-42 162](#_Toc96950194)

[15.4.1.12 Unexisome 163](#_Toc96950195)

[15.5 Addreseable Diseases by Exosome Therapeutic Candidates 163](#_Toc96950196)

[15.6 Exosome-Based Vaccine Development 164](#_Toc96950197)

[15.7 Current Status of Exosome-Based Clinical Trials 165](#_Toc96950198)

[15.8 NIH Funding for Exosome Research 168](#_Toc96950199)

[15.9 Deals and Fund Raising in Exosome Space 169](#_Toc96950200)

[15.9.1 Partnership Deals within Exosome Space 169](#_Toc96950201)

[15.9.1.1 Exopharm and Astellas 169](#_Toc96950202)

[15.9.1.2 Univercells Technologies and RoosterBio 170](#_Toc96950203)

[15.9.1.3 AgeX Therapeutics and UCI 170](#_Toc96950204)

[15.9.1.4 VivaZome and La Trobe University 170](#_Toc96950205)

[15.9.1.5 Evotec SE and Curexsys GmbH 171](#_Toc96950206)

[15.9.1.6 Bio-Techne and QIAGEN 171](#_Toc96950207)

[15.9.1.7 InnoCan Pharma and Recipharms 171](#_Toc96950208)

[15.9.1.8 Sarepta Therapeutics and Codiak Biosciences 172](#_Toc96950209)

[15.9.1.9 Navigo Proteins and MDimune 172](#_Toc96950210)

[15.9.1.10 Evox Therapeutics and Takeda 172](#_Toc96950211)

[15.9.1.11 Jazz Pharmaceuticals and Codiak Biosciences 172](#_Toc96950212)

[15.9.1.12 PureTech Health and Roche 173](#_Toc96950213)

[15.9.1.13 Exosome Diagnostics and Intezyne 173](#_Toc96950214)

[15.9.1.14 Evox Therapeutics and Boehringer Ingelheim 173](#_Toc96950215)

[15.9.2 Acquisition Deals 174](#_Toc96950216)

[15.9.2.1 Lonza’s Acquisition of Exosomics 174](#_Toc96950217)

[15.9.2.2 Lonza and Codiak Biosciences 174](#_Toc96950218)

[15.9.2.3 Bio-Techne and Exosome Diagnostics 174](#_Toc96950219)

[15.9.2.4 Lonza and HansaBioMed 175](#_Toc96950220)

[15.9.3 Licensing Deals 175](#_Toc96950221)

[15.9.3.1 Evox Therapeutics and Eli Lilly 175](#_Toc96950222)

[15.9.3.2 VivaZome Therapeutics and University of Adelaide 176](#_Toc96950223)

[15.9.3.3 CEVEC and Evox Therapeutics 176](#_Toc96950224)

[15.9.3.4 Orgenesis and Excella Bio 176](#_Toc96950225)

[15.9.4 Fund Raising in Exosome Space 177](#_Toc96950226)

[15.9.4.1 Series C Financing Round by Evox Therapeutics 177](#_Toc96950227)

[15.9.4.2 Series B Financing Round for ILIAS Biologics 177](#_Toc96950228)

[15.9.4.3 Initial Public Offering (IPO) by Codiak Biosciences 177](#_Toc96950229)

[15.9.4.4 Series C Funding for ExoCoBio 178](#_Toc96950230)

[15.9.4.5 Common Stock Financing by ArunA Bio 178](#_Toc96950231)

[15.9.4.6 Early-Stage Award for Evox Therapeutics 178](#_Toc96950232)

[15.9.4.7 Series A Funding for ExoCoBio 178](#_Toc96950233)

[15.9.4.8 NIH Grant for Capricor 178](#_Toc96950234)

[15.10 Current Industry Leaders in Exosome Sector 180](#_Toc96950235)

[15.10.1 ArunA Biomedical 180](#_Toc96950236)

[15.10.2 Capricor Therapeutics 180](#_Toc96950237)

[15.10.3 Codiak Biosciences 181](#_Toc96950238)

[15.10.4 Evox Therapeutics 181](#_Toc96950239)

[15.10.5 Exosome Diagnostics, Inc (Bio-Techne) 181](#_Toc96950240)

[15.10.6 Exocyte Therapeutics 182](#_Toc96950241)

[15.10.7 Kimera Labs 182](#_Toc96950242)

[15.10.8 NanoSomiX 182](#_Toc96950243)

[15.11 The Four Categories of Exosome Companies 183](#_Toc96950244)

[15.12 Current Exosome Technologies by Commercial Companies 184](#_Toc96950245)

[15.12.1 Brief Descriptions of Major Exosome Technologies and Companies 185](#_Toc96950246)

[15.12.1.1 AGLE-102 from Aegle Therapeutics 185](#_Toc96950247)

[15.12.1.2 CDC Exosomes from Capricor Therapeutics 185](#_Toc96950248)

[15.12.1.3 engEX Platform from Codiak Biosciences 185](#_Toc96950249)

[15.12.1.4 DeliverEX from Evox Therapeutics 186](#_Toc96950250)

[15.12.1.5 Exo-101 from Exogenus Therapeutics 186](#_Toc96950251)

[15.12.1.6 Hybridozome from Anjarium Biosciences 186](#_Toc96950252)

[15.12.1.7 Neuronal Exosomes from Aruna Bio 187](#_Toc96950253)

[15.12.1.8 ExoPro from ReNeuron 187](#_Toc96950254)

[15.12.1.9 Plexaris from Exopharm Pty., Ltd. 187](#_Toc96950255)

[15.12.1.10 ExoSCRT from ExoCoBio 187](#_Toc96950256)

[16. EXOSOME MARKET ANALYSIS 188](#_Toc96950257)

[16.1 Market for Exosome Therapeutics 188](#_Toc96950258)

[16.2 The Market for Exosome Diagnostics 190](#_Toc96950259)

[16.3 Market for Exosome Research Products 192](#_Toc96950260)

[16.3.1 Market Shares for Exosome Isolation Tools 193](#_Toc96950261)

[16.3.2 Percent Utilization of Research Tools used on Captured Exosomes 194](#_Toc96950262)

[17. PROFILES OF EXOSOME MARKET COMPETITORS 196](#_Toc96950263)

[17.1 101 Bio 197](#_Toc96950264)

[17.1.1 Exosome Services 197](#_Toc96950265)

[17.2 Abbexa, Ltd. 198](#_Toc96950266)

[17.3 Abnova 198](#_Toc96950267)

[17.4 Adipomics, Inc. 199](#_Toc96950268)

[17.5 Aegle Therapeutics 200](#_Toc96950269)

[17.5.1 Extracellular Vesicle Therapy 200](#_Toc96950270)

[17.6 AgeX Therapeutics 201](#_Toc96950271)

[17.6.1 PureStem Technology 201](#_Toc96950272)

[17.6.2 Induced Tissue Regeneration 201](#_Toc96950273)

[17.6.3 UniverCyte 202](#_Toc96950274)

[17.6.4 HyStem Delivery Technology 202](#_Toc96950275)

[17.7 Aethlon Medical, Inc. 203](#_Toc96950276)

[17.7.1 Homopurifier 203](#_Toc96950277)

[17.8 Ambiotech 203](#_Toc96950278)

[17.9 AMS Biotechnology, Ltd. (AMSBIO) 204](#_Toc96950279)

[17.9.1 Products 204](#_Toc96950280)

[17.10 Anjarium Biosciences 205](#_Toc96950281)

[17.10.1 Anjarium’s Hybridosome Platform 205](#_Toc96950282)

[17.11 Antibodies-Online GmbH 205](#_Toc96950283)

[17.12 Aposcience AG 206](#_Toc96950284)

[17.12.1 Wound Healing 206](#_Toc96950285)

[17.12.2 Myocardial Infarction 206](#_Toc96950286)

[17.13 Aruna Bio 207](#_Toc96950287)

[17.13.1 AB126 207](#_Toc96950288)

[17.14 Avalon GloboCare Corp. 208](#_Toc96950289)

[17.14.1 Avalon’s Core Platforms 208](#_Toc96950290)

[17.15 Aviva Systems Biology 208](#_Toc96950291)

[17.16 Azymus Therapeutics 209](#_Toc96950292)

[17.16.1 AZ Platform 209](#_Toc96950293)

[17.17 Beckman Coulter Life Sciences 210](#_Toc96950294)

[17.17.1 Optima XPN 210](#_Toc96950295)

[17.17.2 Vi-CELL BLU – Cell Viability Analyzer 210](#_Toc96950296)

[17.17.3 SW 32 Swinging Bucket Rotor 211](#_Toc96950297)

[17.17.4 CytoFLEX – Flow Cytometer 211](#_Toc96950298)

[17.18 BioCat GmbH 212](#_Toc96950299)

[17.18.1 Exosome Purification Kits 212](#_Toc96950300)

[17.19 BioFluidica 213](#_Toc96950301)

[17.20 Biological Dynamics, Inc. 213](#_Toc96950302)

[17.20.1 Verita Isolation Platform 213](#_Toc96950303)

[17.21 Biorbyt, Ltd. 214](#_Toc96950304)

[17.22 BioRegenerative Sciences, Inc. 215](#_Toc96950305)

[17.22.1 SRM Technology 215](#_Toc96950306)

[17.23 Bio-Techne 216](#_Toc96950307)

[17.23.1 Products 216](#_Toc96950308)

[17.24 BioVision, Inc. 217](#_Toc96950309)

[17.25 BrainStorm Cell Therapeutics 218](#_Toc96950310)

[17.25.1 Exosomes for COVID-19 218](#_Toc96950311)

[17.26 BreStem Therapeutics, Inc. 219](#_Toc96950312)

[17.27 Capricor Therapeutics 220](#_Toc96950313)

[17.27.1 Exosome Program 220](#_Toc96950314)

[17.28 Carmine Therapeutics 221](#_Toc96950315)

[17.29 CD Bioparticles 222](#_Toc96950316)

[17.29.1 Exosome Services 222](#_Toc96950317)

[17.30 Cellarcus Biosciences, Inc. 223](#_Toc96950318)

[17.30.1 vFC Vesicle Analysis Assays 223](#_Toc96950319)

[17.30.2 vTag Antibodies 223](#_Toc96950320)

[17.30.3 Vesicles and Vesicle Standards 224](#_Toc96950321)

[17.30.4 Vesicle Analysis Services 224](#_Toc96950322)

[17.30.5 Measuring EV Size and Concentration 224](#_Toc96950323)

[17.30.6 Quantifying Vesicle Cargo 225](#_Toc96950324)

[17.30.7 Custom Analysis Services 225](#_Toc96950325)

[17.31 Cell Care Therapeutics 225](#_Toc96950326)

[17.31.1 CCT-101 225](#_Toc96950327)

[17.32 Cell Factory BVBA/Esperite NV 226](#_Toc96950328)

[17.32.1 Exosome Projects 226](#_Toc96950329)

[17.33 Cell Guidance Systems, Ltd. 227](#_Toc96950330)

[17.33.1 Exosomes from Cell Guidance 227](#_Toc96950331)

[17.33.2 Exo-Spin Exosome Purification 227](#_Toc96950332)

[17.33.3 Exosome Characterization 228](#_Toc96950333)

[17.33.4 ExoLISA Technology: Exosome Detection 228](#_Toc96950334)

[17.33.5 NTA Size Profiling Service 228](#_Toc96950335)

[17.34 Ciola 229](#_Toc96950336)

[17.34.1 Exosome Customization Technology 229](#_Toc96950337)

[17.35 CK-Exogene 230](#_Toc96950338)

[17.36 Clara Biotech 231](#_Toc96950339)

[17.36.1 ExoRelease 231](#_Toc96950340)

[17.37 Codiak Biosciences 232](#_Toc96950341)

[17.37.1 engEx Platform 232](#_Toc96950342)

[17.37.2 Pipeline Products 232](#_Toc96950343)

[17.37.2.1 exoSTING 232](#_Toc96950344)

[17.37.2.2 exolL-12 233](#_Toc96950345)

[17.37.2.3 exoASO-STAT6 233](#_Toc96950346)

[17.38 Coya Therapeutics, Inc. 234](#_Toc96950347)

[17.39 Craif, Inc. 235](#_Toc96950348)

[17.39.1 Nanowire Device 235](#_Toc96950349)

[17.40 Creative Bioarray 236](#_Toc96950350)

[17.41 CreativeBiostructure 237](#_Toc96950351)

[17.42 Creative Biolabs 238](#_Toc96950352)

[17.42.1 Products 238](#_Toc96950353)

[17.42.2 Services 238](#_Toc96950354)

[17.43 Creative Medical Technology Holdings 239](#_Toc96950355)

[17.43.1 AmnioStem Stroke Therapy 239](#_Toc96950356)

[17.44 Creative Proteomics 240](#_Toc96950357)

[17.44.1 Exosome Proteomics Services 240](#_Toc96950358)

[17.45 Curexsys GmbH 241](#_Toc96950359)

[17.45.1 Technology 241](#_Toc96950360)

[17.46 CUSABIO TECHNOLOGY LLC 242](#_Toc96950361)

[17.46.1 Exosome Isolation Kits 242](#_Toc96950362)

[17.47 Diadem Biotherapeutics 243](#_Toc96950363)

[17.47.1 Technology 243](#_Toc96950364)

[17.48 Direct Bio 244](#_Toc96950365)

[17.48.1 ExoFlo 244](#_Toc96950366)

[17.48.2 AmniWrap 244](#_Toc96950367)

[17.49 DLdevelop 245](#_Toc96950368)

[17.50 Entelexo Biotherapeutics 245](#_Toc96950369)

[17.51 EverZom 246](#_Toc96950370)

[17.51.1 Services 246](#_Toc96950371)

[17.52 Evomic Science LLC 247](#_Toc96950372)

[17.52.1 ExoEZ Exosome Isolation Kit 247](#_Toc96950373)

[17.53 Evora Biosciences SAS 247](#_Toc96950374)

[17.54 Evox Therapeutics, Ltd. 248](#_Toc96950375)

[17.54.1 Protein Therapeutics 248](#_Toc96950376)

[17.54.2 RNA Therapeutics 248](#_Toc96950377)

[17.55 ExBiome BV 249](#_Toc96950378)

[17.55.1 ExomiR Technology 249](#_Toc96950379)

[17.56 Exrkine Corp. 249](#_Toc96950380)

[17.57 ExoCan Healthcare Technologies, Pvt. Ltd. 250](#_Toc96950381)

[17.57.1 ExoEnrich Exosome Isolation Kit 250](#_Toc96950382)

[17.57.2 ExoEngineering 250](#_Toc96950383)

[17.58 ExoCoBio, Co., Ltd. 251](#_Toc96950384)

[17.58.1 Products 251](#_Toc96950385)

[17.59 Exogenus Therapeutics 252](#_Toc96950386)

[17.60 ExoPERT 253](#_Toc96950387)

[17.60.1 EXo-i 253](#_Toc96950388)

[17.61 ExoPharm 254](#_Toc96950389)

[17.61.1 LEAP Technology 254](#_Toc96950390)

[17.61.2 Cevaris & Plexaris 254](#_Toc96950391)

[17.61.3 Partnering Strategy 254](#_Toc96950392)

[17.61.3.1 Exosome Technologies 254](#_Toc96950393)

[17.61.3.2 Exosome Medicines 255](#_Toc96950394)

[17.62 ExosomeDx (biotechne) 256](#_Toc96950395)

[17.62.1 ExoDX Prostate Test 256](#_Toc96950396)

[17.62.2 Pharma Services 256](#_Toc96950397)

[17.63 ExosomePlus 257](#_Toc96950398)

[17.64 Exosome Sciences 258](#_Toc96950399)

[17.64.1 TauSome Biomarker 258](#_Toc96950400)

[17.65 Exosomics S.p.A 259](#_Toc96950401)

[17.65.1 ExoRef 259](#_Toc96950402)

[17.65.2 SeleCTEV-DNA Enrichment Kits 259](#_Toc96950403)

[17.65.3 SoRTEV-RNA Enrichment Kits 259](#_Toc96950404)

[17.65.4 evGAG 260](#_Toc96950405)

[17.66 ExoVectory 260](#_Toc96950406)

[17.66.1 EVY-101 260](#_Toc96950407)

[17.67 Florica Therapeutics 261](#_Toc96950408)

[17.68 GenWay Biotech, Inc. 261](#_Toc96950409)

[17.69 HansaBioMed Lifesiences, Ltd. 262](#_Toc96950410)

[17.69.1 Products 262](#_Toc96950411)

[17.70 ILIAS Biologics, Inc. 263](#_Toc96950412)

[17.70.1 EXPLOR 263](#_Toc96950413)

[17.70.2 Exo-Target 263](#_Toc96950414)

[17.71 Innocan Pharma 264](#_Toc96950415)

[17.71.1 CBD-Loaded Exosomes 264](#_Toc96950416)

[17.72 Innovex Therapeutics, S.L 265](#_Toc96950417)

[17.72.1 Research & Development 265](#_Toc96950418)

[17.73 INOVIQ, Ltd. 266](#_Toc96950419)

[17.73.1 EXO-NET (Research Use only) 266](#_Toc96950420)

[17.74 Invent Biotechnologies, Inc. 267](#_Toc96950421)

[17.75 Izon Science, Ltd. 267](#_Toc96950422)

[17.75.1 qEV Isolation 267](#_Toc96950423)

[17.76 Kimera Labs, Inc. 268](#_Toc96950424)

[17.76.1 XoGlo 268](#_Toc96950425)

[17.76.2 XoGlo Pro 268](#_Toc96950426)

[17.76.3 Equisome HC 269](#_Toc96950427)

[17.77 Leading Biology, Inc. 269](#_Toc96950428)

[17.78 LifeSpan Biosciences, Inc. 270](#_Toc96950429)

[17.79 Lonza Group, Ltd. 270](#_Toc96950430)

[17.79.1 Exosome Service 270](#_Toc96950431)

[17.80 Mantra Bio 271](#_Toc96950432)

[17.80.1 Partnering 271](#_Toc96950433)

[17.81 MDimune, Inc. 272](#_Toc96950434)

[17.81.1 BioDrone Technology 272](#_Toc96950435)

[17.82 Miltenyi Biotech B.V. and Co., KG 273](#_Toc96950436)

[17.82.1 qEV Exosome Isolation Kit 273](#_Toc96950437)

[17.83 miR Scientific 274](#_Toc96950438)

[17.83.1 Prostate Cancer Test 274](#_Toc96950439)

[17.84 Mursla, Ltd. 275](#_Toc96950440)

[17.84.1 ExoPheno 275](#_Toc96950441)

[17.85 MyBioSource, Inc. 276](#_Toc96950442)

[17.86 NanoSomics, Inc. 277](#_Toc96950443)

[17.86.1 Technology 277](#_Toc96950444)

[17.87 NanoView Biosciences 277](#_Toc96950445)

[17.87.1 ExoView R200 278](#_Toc96950446)

[17.87.2 ExoView R100 278](#_Toc96950447)

[17.87.3 ExoView Tetraspanin Kits 278](#_Toc96950448)

[17.87.4 ExoFlex Kits 278](#_Toc96950449)

[17.88 NeurExo Sciences 279](#_Toc96950450)

[17.88.1 Research & Development Programs 279](#_Toc96950451)

[17.89 NeuroDex, Inc. 280](#_Toc96950452)

[17.90 NurExone Biologic Ltd 280](#_Toc96950453)

[17.91 New England Peptide, Inc. 281](#_Toc96950454)

[17.91.1 ME- Kit for Exosome Isolation 281](#_Toc96950455)

[17.92 Norgen Biotek Corp. 282](#_Toc96950456)

[17.92.1 Services 282](#_Toc96950457)

[17.93 Novus Biologicals, LLC 283](#_Toc96950458)

[17.93.1 Exosome Research Tools 283](#_Toc96950459)

[17.94 nRix Dx, Inc. 284](#_Toc96950460)

[17.95 Oasis Diagnostics Corporation 285](#_Toc96950461)

[17.95.1 Pure.SAL 285](#_Toc96950462)

[17.96 OmniSpirant, Ltd. 286](#_Toc96950463)

[17.96.1 Technology 286](#_Toc96950464)

[17.97 Organicell 286](#_Toc96950465)

[17.98 OriGene Technologies, Inc. 288](#_Toc96950466)

[17.99 Paracrine Therapeutics, Pvt. Ltd. 288](#_Toc96950467)

[17.100 QIAGEN 289](#_Toc96950468)

[17.100.1 ExoEasy Maxi Kit 289](#_Toc96950469)

[17.100.2 miRCURY Exosome Kits 289](#_Toc96950470)

[17.100.3 miRCURY LNA miRNA Focus PCR Panels 290](#_Toc96950471)

[17.101 ReNeuron 290](#_Toc96950472)

[17.101.1 Exosome Platform 290](#_Toc96950473)

[17.102 RION 291](#_Toc96950474)

[17.102.1 Technology 291](#_Toc96950475)

[17.103 RoosterBio, Inc. 292](#_Toc96950476)

[17.103.1 RoosterCollect-EV 292](#_Toc96950477)

[17.103.2 RoosterCollect EV Pro 292](#_Toc96950478)

[17.103.3 RoosterCollect-EV-CC 292](#_Toc96950479)

[17.103.4 EV Boost 293](#_Toc96950480)

[17.104 Rosetta Exosome 293](#_Toc96950481)

[17.106 System Biosciences, LLC 295](#_Toc96950482)

[17.106.1 Exosome Research Products 295](#_Toc96950483)

[17.106.2 Exosome Research Services 295](#_Toc96950484)

[17.107 Tavec Pharma 296](#_Toc96950485)

[17.107.1 Technology 296](#_Toc96950486)

[17.107.2 Acquisition by Therillia 296](#_Toc96950487)

[17.108 Theoria Science, Inc. 297](#_Toc96950488)

[17.108.1 Technology: ExoScreen 297](#_Toc96950489)

[17.109 Thermo Fisher Scientific 298](#_Toc96950490)

[17.109.1 Exosome Products for Testing and Research 298](#_Toc96950491)

[17.110 TransGen Biotech, Co., Ltd. 299](#_Toc96950492)

[17.111 TriArm Therapeutics, Co., Ltd. 299](#_Toc96950493)

[17.111.1 Exosome Engineering Platform 299](#_Toc96950494)

[17.112 United Therapeutics Corp. 300](#_Toc96950495)

[17.112.1 Unexisome 300](#_Toc96950496)

[17.113 Versatope Therapeutics 301](#_Toc96950497)

[17.113.1 VT-105 301](#_Toc96950498)

[17.114 Vesigen Therapeutics, Inc. 302](#_Toc96950499)

[17.114.1 Technology 302](#_Toc96950500)

[17.115 VivaZome Therapeutics, Pvt. Ltd. 303](#_Toc96950501)

[17.115.1 VivaZome’s Collaboration with ANU 303](#_Toc96950502)

[17.115.2 VivaZome’s Collaboration with ReNerve 303](#_Toc96950503)

[17.116 Xollent Biotech 304](#_Toc96950504)

[17.116.1 Pipeline 304](#_Toc96950505)

[17.117 XOStem, Inc. 305](#_Toc96950506)

[17.118 YMAIR Genomics, LLC 306](#_Toc96950507)

[17.118.1 Urine Biomarker Isolation Method 306](#_Toc96950508)

[17.118.2 Ymatrix 306](#_Toc96950509)

**INDEX OF FIGURES**

[FIGURE 2.1: Classification of Extracellular Vesicles 22](#_Toc96950510)

[FIGURE 2.2: Exosome Formation 23](#_Toc96950511)

[FIGURE 2.3: Exosome Uptake by Target Cells 24](#_Toc96950512)

[FIGURE 2.4: Structure of an Exosome 25](#_Toc96950513)

[FIGURE 2.5: Schematic of Membrane and Lumen Components of Exosomes 29](#_Toc96950514)

[FIGURE 2.6: Classification of Exosomes according to Origin 30](#_Toc96950515)

[FIGURE 2.7: Methods of Isolation for Natural Exosomes 31](#_Toc96950516)

[FIGURE 2.8: Exosomes with Loaded Therapeutics in the Lumen and Surface Display 32](#_Toc96950517)

[FIGURE 2.9: Schematic Representation of Therapeutic Applications of Exosomes 33](#_Toc96950518)

[FIGURE 2.10: Sources of Exosomes for Research 36](#_Toc96950519)

[FIGURE 3.1: Pre-Isolation Interior Modification Methods 41](#_Toc96950520)

[FIGURE 3.2: Post-Isolation Interior Modification Methods 42](#_Toc96950521)

[FIGURE 3.3: Surface Modification through the Parent Cells 43](#_Toc96950522)

[FIGURE 3.4: Direct Surface Modification 44](#_Toc96950523)

[FIGURE 5.1: Common Isolation Methods in Exosome Research 58](#_Toc96950524)

[FIGURE 5.2: Exosome Labeling Methods in Exosome Biodistribution Analysis 62](#_Toc96950525)

[FIGURE 5.3: Fluorescent Dyes used in Exosome Labeling 63](#_Toc96950526)

[FIGURE 5.4: Common Methods to Remove Unlabelled Probes 63](#_Toc96950527)

[FIGURE 5.5: Determination of Exosome Dose in Exosome Studies 64](#_Toc96950528)

[FIGURE 5.6: Routes of Exosome Administration 65](#_Toc96950529)

[FIGURE 5.7: Tested and Non-Tested Exosomes in Research 65](#_Toc96950530)

[FIGURE 7.1: Number of PubMed Publications on Exosomes, 2010-2021 70](#_Toc96950531)

[FIGURE 7.2: Top Five Countries with Largest Number of Publications 71](#_Toc96950532)

[FIGURE 7.3: Number of PubMed Publications on Exosome DNA as Diagnostics 72](#_Toc96950533)

[FIGURE 7.4: Number of PubMed Publications on Exosome RNA as Diagnostics 73](#_Toc96950534)

[FIGURE 7.5: PubMed Publications on Exosome Proteins as Diagnostics 74](#_Toc96950535)

[FIGURE 7.6: PubMed Publications on Exosomes Derived from Stem Cells 75](#_Toc96950536)

[FIGURE 7.7: PubMed Publications on Exosome-based Diagnostics 76](#_Toc96950537)

[FIGURE 7.8: PubMed Publications on Exosome-based Therapeutics 77](#_Toc96950538)

[FIGURE 7.9: PubMed Publications on Exosomes for Cancer Diagnosis 78](#_Toc96950539)

[FIGURE 7.10: Publications on Exosome Diagnostics for Pregnancy Disorders 79](#_Toc96950540)

[FIGURE 8.1: Patents/Applications Related to Exosome-Sources 81](#_Toc96950541)

[FIGURE 8.2: Patents/Applications Related to Exosomes-Isolation/Preparation 82](#_Toc96950542)

[FIGURE 8.3: Patents/Applications Related to Type of Cargo 82](#_Toc96950543)

[FIGURE 8.4: Patents/Applications Related to Cargo Loading Methods 83](#_Toc96950544)

[FIGURE 8.5: Patents/Applications Related to Therapy Area 84](#_Toc96950545)

[FIGURE 8.6: Leading Assignees of Exosome Patents 85](#_Toc96950546)

[FIGURE 9.1: Exosome Clinical Trials by Geography 96](#_Toc96950547)

[FIGURE 10.1: Schematic Models of Continuous Exosome Manufacturing Approaches 101](#_Toc96950548)

[FIGURE 10.2: Upstream Cell Line Production Methods 102](#_Toc96950549)

[FIGURE 10.3: Downstream Exosome Purification Methods 103](#_Toc96950550)

[FIGURE 11.1: Diagrammatic Representation of Differential Centrifugation 106](#_Toc96950551)

[FIGURE 11.12: Diagrammatic Representation of Gradient Density Ultracentrifugation 106](#_Toc96950552)

[FIGURE 11.3: Diagrammatic Representation of Ultrafiltration & Sequential Ultrafiltration 107](#_Toc96950553)

[FIGURE 11.4: Diagrammatic Representation of Size-Exclusion Chromatography 108](#_Toc96950554)

[FIGURE 11.5: Diagrammatic Representation of Polymer Precipitation 108](#_Toc96950555)

[FIGURE 11.6: Diagrammatic Representation of Immunoaffinity Capture 109](#_Toc96950556)

[FIGURE 11.7: Diagrammatic Representation of Microfluidics-based Techniques 110](#_Toc96950557)

[FIGURE 11.8: Comparative Yield of Exosomes by Isolation Techniques 113](#_Toc96950558)

[FIGURE 11.9: Relative Viability of Exosomes by Isolation Technique 114](#_Toc96950559)

[FIGURE 12.1: Number of PubMed Published on Exosome Diagnostics, 2015-2021 138](#_Toc96950560)

[FIGURE 13.1: Schematic Illustration of Key Points in Exosomes as Drug Delivery Systems 140](#_Toc96950561)

[FIGURE 13.2: Sketch of a Naïve Exosome with Not-Fully Identified Functional Molecules 143](#_Toc96950562)

[FIGURE 13.3: Passive Cargo Loading 144](#_Toc96950563)

[FIGURE 13.4: Active Cargo Loading with Anchored Cargo 145](#_Toc96950564)

[FIGURE 13.5: Active Cargo Loading with Free-Cargo 145](#_Toc96950565)

[FIGURE 15.1: Diagnostic Applications of Exosomes 155](#_Toc96950566)

[FIGURE 16.1: Market for Exosome Therapeutics and Diagnostics by Region, 2022-2030 191](#_Toc96950567)

[FIGURE 16.2: Market for Exosome Research Products by Region, 2022-2030 193](#_Toc96950568)

[FIGURE 16.3: Market Shares for Exosome Isolation Tools 194](#_Toc96950569)

[FIGURE 16.4: Percent Utilization of Research Tools used on Captured Exosomes 195](#_Toc96950570)

**INDEX OF TABLES**

[TABLE 2.1: Molecular Contents of Exosomes 25](#_Toc96950625)

[TABLE 2.2: Common Protein Contents of Exosomes 26](#_Toc96950626)

[TABLE 2.3: Common Lipid Contents of Exosomes 27](#_Toc96950627)

[TABLE 2.4: Nucleic Acids Present in Cancer-Derived Exosomes 28](#_Toc96950628)

[TABLE 2.5: Types of Therapeutic Cargo used in Exosome Modifications 32](#_Toc96950629)

[TABLE 2.6: Differences between Exosome Therapy and Cell Therapy 35](#_Toc96950630)

[TABLE 2.7: Comparative Studies using Exosomes from Different Sources 37](#_Toc96950631)

[TABLE 3.1: Examples of Loaded and Displayed Molecules in Direct Exosome Engineering 45](#_Toc96950632)

[TABLE 3.2: Advantages and Disadvantages of Exosome Preparation Methods 46](#_Toc96950633)

[TABLE 3.3: Targeted Moieties used in Developing Targeted Designer Exosomes 47](#_Toc96950634)

[TABLE 3.4: Exosome-Based Clinical Trials for Cancer Treatment and Diagnostics 48](#_Toc96950635)

[TABLE 4.1: Select Preclinical Studies addressing Cardiovascular Diseases 51](#_Toc96950636)

[TABLE 4.2: Select Preclinical Studies addressing Kidney Diseases 52](#_Toc96950637)

[TABLE 4.3: Select Preclinical Studies addressing Liver Diseases 53](#_Toc96950638)

[TABLE 4.4: Select Preclinical Studies addressing Wound Healing 54](#_Toc96950639)

[TABLE 4.5: Select MSC Exosome-Based Clinical Trials for Regenerative Medicines 55](#_Toc96950640)

[TABLE 5.1: Comparison of MISEV2018 and MFDS2018 Guidelines 59](#_Toc96950641)

[TABLE 5.2: Comparison of Imaging Modalities used in Exosome Research 60](#_Toc96950642)

[TABLE 5.3: Comparison of Exosome Labeling Methods 61](#_Toc96950643)

[TABLE 6.1: Commercially Available Exosome Isolation Kits 66](#_Toc96950644)

[TABLE 6.1: (CONTINUED) 67](#_Toc96950645)

[TABLE 6.2: Exosome-associated RNA Isolation Kits 67](#_Toc96950646)

[TABLE 6.3: Commercially Available Exosome Standards 68](#_Toc96950647)

[TABLE 6.4: Commercially Available Immunoplates for Capturing Exosomes 68](#_Toc96950648)

[TABLE 6.5: Commercially Available Immunobeads for Exosome Isolation 69](#_Toc96950649)

[TABLE 6.6: Commercially Available Exosome Marker Antibodies 69](#_Toc96950650)

[TABLE 8.1: Exosome Patent Assignees in 2021 80](#_Toc96950651)

[TABLE 9.1: Recruitment Status for Exosome-based Clinical Trials 93](#_Toc96950652)

[TABLE 9.2: Study Designs of Ongoing Exosome Clinical Trials 93](#_Toc96950653)

[TABLE 9.3: Study Phases in Clinical Trials 94](#_Toc96950654)

[TABLE 9.4: Phase III & Phase IV Studies in Clinical trials 95](#_Toc96950655)

[TABLE 9.5: Funding Types for Exosome-based Studies 95](#_Toc96950656)

[TABLE 9.6: Examples of Clinical Trials involving MSC-Derived Exosomes 97](#_Toc96950657)

[TABLE 9.7: Examples of Clinical Trials involving Drug-Loaded Exosomes 98](#_Toc96950658)

[TABLE 10.1: Companies Offering Exosome-Related Services 103](#_Toc96950659)

[TABLE 10.1: (CONTINUED) 104](#_Toc96950660)

[TABLE 11.1: Current Strategies for Exosome Isolation 105](#_Toc96950661)

[TABLE 11.2: Active and Passive Methods of Microfluidics-based Platforms 110](#_Toc96950662)

[TABLE 11.3: Features of Microfluidics-based Techniques 111](#_Toc96950663)

[TABLE 11.4: Commercially Available Exosome Isolation Kits 112](#_Toc96950664)

[TABLE 11.5: Summary of Different Exosome Isolation Techniques 115](#_Toc96950665)

[TABLE 11.6: Approaches for Exosome Analysis of Gene and Protein Biomarkers 118](#_Toc96950666)

[TABLE 11.7: Emerging Optical Technologies for Exosome Analysis 118](#_Toc96950667)

[TABLE 11.8: Electrochemical and Electromechanical Approaches for Exosome Analysis 123](#_Toc96950672)

[TABLE 12.1: Exosomal Cargo as Biomarkers for Disease Diagnosis 124](#_Toc96950673)

[TABLE 12.1: (CONTINUED) 125](#_Toc96950674)

[TABLE 12.2: Exosomal Proteins in Different Cancers 125](#_Toc96950675)

[TABLE 12.3: Types of RNA as Biomarkers for Cancers 129](#_Toc96950679)

[TABLE 12.4: Non-Coding RNAs in Exosomes as Biomarkers for Cancers 133](#_Toc96950683)

[TABLE 12.5: Exosome Biomarkers for Cancer from other Body Fluids 134](#_Toc96950684)

[TABLE 12.6: Target Exosome Molecules for Diagnosis in Pregnancy Disorders 135](#_Toc96950685)

[TABLE12.6: (CONTINUED) 136](#_Toc96950686)

[TABLE 12.7: Target Molecules of Exosomes for Diagnosis after Organ Transplantation 137](#_Toc96950687)

[TABLE 12.8: Examples of Clinical Trials involving Exosome-based Diagnostics 139](#_Toc96950688)

[TABLE 13.1: List of Commercial Companies Developing Exosomes Therapies 141](#_Toc96950689)

[TABLE 13.2: Summary of Cargo Loading Methods 146](#_Toc96950690)

[TABLE 13.3: Examples of Drugs Encapsulated in Exosomes 148](#_Toc96950691)

[TABLE 13.4: Preclinical Studies involving Drug-Loaded Exosomes 149](#_Toc96950692)

[TABLE 13.4: (CONTINUED) 150](#_Toc96950693)

[TABLE 13.5: Phase III Clinical Trials involving Exosome Therapeutics 150](#_Toc96950694)

[TABLE 14.1: The Potential of a New Approach to Cancer Vaccines in Animal Models 151](#_Toc96950695)

[TABLE 14.2: Ongoing Clinical Trials of Exosome-Based Cancer Immunotherapy 152](#_Toc96950696)

[TABLE 15.1: Companies Developing Exosome-Based Diagnostics 157](#_Toc96950697)

[TABLE 15.2: Select Clinical Trials Evaluating Exosome Diagnostics 157](#_Toc96950698)

[TABLE 15.3: List of Commercial Companies Developing Exosome Therapeutics 158](#_Toc96950699)

[TABLE 15.4: Promising Exosome-Based Therapeutic Candidates 159](#_Toc96950700)

[TABLE 15.5: A Short List of Diseases Addressed by Exosome Therapeutics 163](#_Toc96950701)

[TABLE 15.6: Current Clinical Trials Update on Exosomal Vaccine Development 164](#_Toc96950702)

[TABLE 15.7: Select Exosome-Based Clinical Trials 166](#_Toc96950703)

[TABLE 15.7: (CONTINUED) 167](#_Toc96950704)

[TABLE 15.8: The List of NIH Funding for Exosome-Based Research in 2022 168](#_Toc96950705)

[TABLE 15.9: Deals and Fund Raising in Exosome Space, 2016-2022 179](#_Toc96950706)

[TABLE 15.10: The Four Categories of Exosome Companies 183](#_Toc96950707)

[TABLE 15.11: Exosome Technologies Developed by Commercial Companies 184](#_Toc96950708)

[TABLE 16.1: Market for Exosome Therapeutics and Diagnostics by Region, 2022-2030 191](#_Toc96950709)

[TABLE 16.2: Market for Exosome Research Products by Region, 2022-2030 192](#_Toc96950710)

[TABLE 17.1: Aruna Bio’s Product Pipeline 207](#_Toc96950711)

[TABLE 17.2: BioCat’s Exosome Tools: An Overview 212](#_Toc96950712)

[TABLE 17.3: BreStem’s Pipeline 219](#_Toc96950713)

[TABLE 17.4: Capricor’s Product Pipeline 220](#_Toc96950714)

[TABLE 17.5: Cell Factory’s Exosome Drug Candidates 226](#_Toc96950715)

[TABLE 17.6: Codiak’s engEx Therapeutic Pipeline 233](#_Toc96950716)

[TABLE 17.7: Coya’s Pipeline 234](#_Toc96950717)

[TABLE 17.8: Curexsys’ Products in Pipeline 241](#_Toc96950718)

[TABLE 17.9: ILIAS Product Pipeline 263](#_Toc96950719)

[TABLE 17.10: MDimune’s Exosome-Based Products in Development 272](#_Toc96950720)

[TABLE 17.11: NeurExo’s Research & Development Programs 279](#_Toc96950721)

[TABLE 17.12: Organicell’s Product Pipeline 287](#_Toc96950722)

[TABLE 17.13: Organicell’s Pipeline – Compassionate Use IND 287](#_Toc96950723)

[TABLE 17.14: RION’s Pipeline of Products 291](#_Toc96950724)

[TABLE 17.15: Xollent’s Product Candidates 304](#_Toc96950725)

[TABLE 17.16: All Known Exosome Companies Worldwide by Region and Activity 307](#_Toc96950726)

**About BioInformant**

BioInformant is the first and only market research firm to specialize in the stem cell industry.

BioInformant research has been cited by prominent news outlets that include the Wall Street Journal, Nature Biotechnology, Xconomy, and Vogue Magazine.

Serving Fortune 500 companies that include Pfizer, Goldman Sachs, and GE Healthcare, BioInformant is your global leader in stem cell industry data.