TABLE OF CONTENTS

CHAPTER ONE: EXECUTIVE SUMMARY

- Introduction
 - New Systems, Services Create Uncertainty
 - A Period of Rapid Adoption, But Lower Prices
 - Further Longer-Term Challenges
 - Rapid Growth Overall, But Intense Competition
 - Customers' Research Models Evolving
 - Established Next-Generation Systems Seeing Slowdown
- Background
 - Scope and Methodology
 - Applications and Definitions
 - Types of Samples
 - DNA Sequencing Strategies

CHAPTER TWO: SEQUENCER MARKET TRENDS

- Industry and Technology Trends
 - Market Fragmenting Into Multiple Product Types and Applications
 - Continual Improvements Expand Sequencer Market
 - Acquisitions and Collaborations for New Technologies
 - Patent Infringement, Other Legal Disputes
 - Slow Path to Potentially Large Clinical Markets
 - Spread of Targeted Enrichment, Sequence-Capture Products and Services
 - Synergies Appearing Between Life Science Companies' Products
 - Consumer Genomics, Genetic Testing, Pharmacogenetics Still Entering Mainstream
- NHGRI Funding, Budget, Periodic Strategic Planning
 - NHGRI Shifts Funds from Centralized Sequencing Centers
 - NHGRI White Paper #4: The Future of Genome Sequencing
- Genome Projects and Consortia
 - The Cancer Genome Atlas (TCGA) Project
 - National Plant Genome Initiative
 - NSF/USDA Microbial Genome Sequencing Program

CHAPTER THREE: DNA SEQUENCING SYSTEMS AND TECHNOLOGIES

- 454 Life Sciences (Roche)
 - Genome Sequencer FLX, FLX+, Junior
 - o Illumina
 - HiSeq, HiScan SQ, MiSeq, Genome Analyzer IIx
 - Intelligent Biosystems (Qiagen)/Azco Biotech
 - LI-COR Biosciences 4300
 - Life Technologies/Applied Biosystems

- ABI Prism 310 Genetic Analyzer
- ABI Prism 3100-Avant Genetic Analyzer
 - Applied Biosystems 3100 Genetic Analyzer
 - Applied Biosystems 3130 Genetic Analyzer
 - Applied Biosystems 3130xl Genetic Analyzer
 - Applied Biosystems 3500 Genetic Analyzer
 - Applied Biosystems 3730 DNA Analyzer
 - Applied Biosystems 3730xl DNA Analyzer
 - ABI SOLiD 4, 5500, 5500xl, 5500xl W Genetic Analyzers
 - Ion Torrent Personal Genome Machine (PGM)
- Pacific Biosciences
 - PacBio RS
 - Technologies Under Development
 - Introduction
 - Human Microbiome Project Technology Development Awards

CHAPTER FOUR: SEQUENCING MARKET ANALYSIS

- Revenues Forecast
- Historical Revenues
- Overall Market Forecast
- Sequencing For a Clinical Purpose
 - Roche
 - o ABI
 - o Illumina
 - Affymetrix
 - B.C. Cancer Agency
 - Emory Genetics Lab
 - Bacterial and Viral Applications for NGS
 - eGenomics
 - o BGI
 - Pacific Biosciences
 - o Clinical Sequencing vs. Research Sequencing Markets

CHAPTER FIVE: COMPETITIVE ANALYSIS

- Introduction
 - Benchtop and Third-Generation Sequencers Bring Instability
 - Second-, Third-Generation Battle Still Undefined, Unresolved
 - Increased Flexibility with Purchasing
 - ABI Capillary Electrophoresis Holds Onto Large Segment
- DNA Sequencer Market Shares
 - Smaller Companies Experiencing Struggles
- Features and Strengths of Second-Generation Sequencers
 - o 454 Life Sciences GS FLX-Strengths/Advantages
 - o 454 Life Sciences GS FLX-Weaknesses/Disadvantages

- 454 Life Sciences GS Junior–Strengths/Advantages
- o 454 Life Sciences GS Junior-Weaknesses/Disadvantages
- o Applied Biosystems SOLiD-Strength/Advantages
- Applied Biosystems SOLiD–Weaknesses/Disadvantages
- Illumina HiSeq/HiScan SQ–Strength/Advantages
- Illumina HiSeq/HiScan SQ–Weaknesses/Disadvantages
- Illumina MiSeq Strength/Advantages
- o Illumina MiSeq-Weaknesses/Disadvantages
- o Life Technologies PGM-Weaknesses/Disadvantages
- Pacific Biosciences PacBio RS-Strength/Advantages
- Pacific Biosciences PacBio RS-Weaknesses/Disadvantages

CHAPTER SIX: INTELLECTUAL PROPERTY AND LITIGATION

- Developments
 - Helicos' Patent Infringement Suit Against PacBio, Life Technologies, and Illumina
 - o Intelligent Bio-Systems and Columbia University Sue Illumina for Infringement
 - Illumina's Two Lawsuits Against Complete Genomics for Infringement
 - Illumina Sues Life Technologies Over Ion Torrent Systems
 - Class Action Shareholder Lawsuit Filed Against Pacific Biosciences
 - Affymetrix Dismisses Suit Against Pacific Biosciences and Former Employees
 - Life Technologies Defeats VisiGen Stakeholders After Arbitration
 - Catalyst Assets Sues Life Technologies for Infringement
 - Patent Interference Between Life Technologies and Pacific Biosciences
 - Life Technologies and Illumina Dispute Over Amplification on Solid Surfaces
 - o LadaTech Sues Illumina Over DNA Amplification Patent
 - o Illumina Files '841 Patent Infringement Suit Against Affymetrix
 - Affymetrix and Illumina Settle Case Over '243, '432, '531, '365, and '716
 - Applied Biosystems and Illumina Claims and Counter-claims Over Sequencingby-Ligation Both Unsuccessful
 - Fluidigm and Applied Biosystems Agree to End Case
 - Beckman Coulter and Applied Biosystems Settle Outstanding Legal Disputes
 - Cepheid and Idaho Technology Settle Dispute Over PCR Patents
 - Enzo Biochem Disputes CalTech Sequencing Patents
 - Huang v. CalTech
 - Applied Biosystems and Amersham plc (GE Healthcare) Settle Sequencing Patent Litigation
 - Early ABI (Life Technologies) Patents

CHAPTER SEVEN: DEALS

• List of Deals in the Sequencing Industry

CHAPTER EIGHT: CORPORATE PROFILES

- 454 Life Sciences (Roche)
- Complete Genomics
- Illumina
- Life Technologies
- Pacific Biosciences

CHAPTER NINE: CHALLENGES AND STRATEGIC RECOMMENDATIONS

- Market Challenges
 - Fragmentation of Market Complicates Competition
 - and several others....
- Strategic Recommendations
 - o Intense Competition Requires Constant Innovation
 - and several others...

LIST OF EXHIBITS

CHAPTER ONE: EXECUTIVE SUMMARY

• Figure 1-1: DNA Sequencer Revenues, 2001-2011

CHAPTER TWO: SEQUENCER MARKET TRENDS

- Table 2-1: NHGRI Budget by Year Including ARRA Supplement, 2006-2012
- Figure 2-1: NHGRI Budget including ARRA (2006-2012)
- Table 2-2: Est. NHGRI Budget by Mechanism, 2012 (\$M)
- Figure 2-2: NHGRI Budget
- Table 2-3: NHGRI Budget by Activity, 2010-2012 (\$thou)
- Figure 2-3: NHGRI Budget by Activity, 2012
- Table 2-4: NHGRI Funding, Large-Scale Sequencing Centers '07&'12
- Figure 2-4: NHGRI Funding, Large-Scale Sequencing Centers '07&'12
- Table 2-5: NHGRI Funding, Centers for Mendelian Genomics, 2012
- Figure 2-5: NHGRI Funding, Centers for Mendelian Genomics, 2012
- Table 2-6: NHGRI Clinical Sequencing Exploratory Research Awards, 2012
- Table 2-7: Fuge Funding Recipients
- Table 2-8: Plant Genome Comparative Sequencing Program (PGCSP) Awards, FY 2011
- Table 2-9: NSF / USDA Microbial Genome Sequencing Program Awards, 2008-2011
- Table 2-10 Other Initiatives and Consortia Using DNA Sequencing, 2012

CHAPTER THREE: DNA SEQUENCING SYSTEMS AND TECHNOLOGIES

- Table 3-1: DNA Sequencer Products/ Technologies, 2012
- Table 3-2: NIH Human Microbiome Project Technology Dev't Awards, 2010
- Table 3-3: NHGRI \$1,000 Genome Grant Awards, 2009
- Table 3-4: NHGRI \$1,000 Genome Grant Awards, 2010
- Table 3-5: NHGRI \$1,000 Genome Grant Awards, 2011

- Table 3-6: NHGRI Advanced Sequencing Technology Awardees, 2009
- Table 3-7: NHGRI Medical Sequencing Discovery Awards, 2009
- Table 3-8: NHGRI Understanding Genome Function Awards, 2009
- Table 3-9: NHGRI Population Genomics Awards, 2009
- Table 3-10: NHGRI Advanced Sequencing Technology Awardees, 2009
- Table 3-11: Other Initiatives and Consortia Supporting Technology Development, 2012

CHAPTER FOUR: SEQUENCING MARKET ANALYSIS

- Figure 4-1: Cost of Sequencing a Genome
- Table 4-1: Market Forecast by Segment (Systems, Consumables, Services), 2011-2016
- Table 4-2: Sequencing Market Revenues Growth Rates by Segment, 2011-2016 (Systems, Consumables, Services)
- Table 4-3: Sequencer Equipment Market, 2001-2011 (\$M)
- Table 4-4: Growth Rates, Sequencer Equipment Market, 2001-2011 (\$M)
- Figure 4-3: Sequencer Equipment Market, 2001-2011 (\$M)
- Figure 4-4: ABI Sequencing Revenues, Q3 2001 Q3 2008
- Figure 4-5: ABI Sequencing Revenues, Focus on Q4 2004 Q3 2008
- Figure 4-6: DNA Sequencer Market Forecast, 2011-2016:
- Figure 4-7: Breakout of DNA Sequencing Market by Application(Clinical vs. Research) 2011
- Figure 4-8: Breakout of DNA Sequencing Market by Application(Clinical vs. Research) 2016

CHAPTER FIVE: COMPETITIVE ANALYSIS

- Table 5-1: DNA Sequencer Market Shares
- Figure 5-1: DNA Sequencer Market Shares
- Figure 5-2: Pacific Biosciences Quarterly Revenues, 2011-2012 (\$M)
- Figure 5-3: Complete Genomics Quarterly Revenues, 2010-2012 (\$M)
- Table 5-2 Comparison of Sequencers' Performance, mid-2012

CHAPTER SIX: INTELLECTUAL PROPERTY AND LITIGATION

• Table 6-1: Patents

CHAPTER SEVEN: DEALS

• Table 7-1: Deals in the Sequencer Market