Biomarkers in Drug Discovery
Integration in Early Stage Promotes Use of Companion Diagnostics to Optimize Therapeutic Outcomes
GBI Research Report Guidance

The report provides in-depth analysis of biomarkers’ potential applications in the pharmaceutical drug discovery process.

- Chapter three describes the history of biomarkers and how they fulfill the unmet needs of the conventional drug discovery process. It also discusses the biomarker discovery and validation process.
- Chapter four describes the market for biomarkers in drug discovery along with revenue forecasts until 2018 and market drivers and barriers.
- Chapter five analyses the key issues faced historically in the application of biomarkers and future developments expected in the industry.
- Chapter six discusses important types of technology being used in the discovery of biomarkers, highlighting their impact over the biomarker discovery process.
- Chapter seven evaluates the advantages and disadvantages of using biomarkers in the drug discovery process.
- Chapter eight studies the integration of different types of biomarkers in each phase of the drug discovery and development process and how it has helped to reduce cost and time-to-market for clinical trials.
- Chapter nine discusses two case studies for the application of biomarkers in the successful development of drugs for the treatment of two different types of cancer.
- Chapter 10 describes current regulatory trends in the global biomarkers drug discovery market as well as FDA biomarker validation.
- Chapter 11 provides detailed analysis of the most promising biomarkers expected to enter the market in the next couple of years for certain key therapies.
- The final chapter discusses the strategic consolidations that have taken place within the global biomarkers market, including M&A and strategic partnerships among companies involved in the manufacturing of biomarkers for drug discovery and research.
Executive Summary

Biomarkers Market Expects Significant Growth

The global biomarkers market is an established market that has seen substantial growth since 2004 due to factors such as improvements in technology and the creation of favorable regulatory norms for the application of biomarkers in drug discovery.

The biomarkers market was valued at $XX billion in 2004 and increased to $XX billion in 2011 at a CAGR of XX%. The majority of revenue is generated through the application of biomarkers in the discovery, testing and prescription of oncology therapeutics, making it one of the biggest therapeutic areas. The other leading therapeutic areas are Central Nervous System (CNS) and Cardiovascular System (CVS) disorders.

Growing Emphasis on Personalized Medicine and Companion Diagnostics

Historically, drug R&D processes were shaped by the conventional symptom-based approach, which considered that if the majority of patients responded favorably to a particular drug, for those who showed some side effects an alternative treatment would be more effective. This approach was known as the ‘one-size-fits-all’ or ‘blockbuster’ model and led to issues such as higher R&D costs, longer development timelines and narrow product portfolios. Additionally, higher attrition rates led to a decline in the number of products approved despite huge investments in R&D. This led to the emergence of personalized medicine that allow individual targeted treatments to be designed according to genetic codes, ensuring a reduction in drug discovery costs and attrition rates. Companion diagnostics also play an important role in the realization of personalized medicine, as they are assays (tests or measurements) intended to assist physicians when making treatment decisions for their patients.
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2 Biomarkers in Drug Discovery - Introduction

2.1 Introduction

According to the Food and Drug Administration (FDA), a biological marker or biomarker is defined as a characteristic that is objectively measured and evaluated as an indicator of normal biologic processes, pathogenic processes, or biological responses to a therapeutic intervention. It can define a physiologic, pathologic, or anatomic characteristic or measurement thought to relate to an aspect of normal or abnormal biologic function. Changes in biomarkers following treatment may predict or identify safety problems related to a drug candidate or reveal pharmacological activity expected to predict an eventual benefit from treatment. Biomarkers can also reduce uncertainty in drug development and evaluation by providing quantitative predictions about drug performance.

In general, biomarkers are available in the form of specific enzyme or hormone concentrations and genetic or phenotypic distributions. They work as pharmacodynamic indicators of the drug in a clinical study for drug discovery. Biomarkers are detectable, computable and quantifiable substances that change in response to a chemical/biological stimulus and are used to quantify Absorption, Distribution, Metabolism, Excretion and Toxicity (ADMET) properties to identify drug response in clinical studies.

The following figure lists some commonly identified biomarkers:

Prior to the application of biomarkers, the conventional drug discovery process (symptom-based) had various drawbacks such as high attrition rates, high costs and erroneous predictions of drug safety and efficiency. The integration of biomarkers has tried to address these issues and has made the process smoother and less costly. The symptom-based approach or the ‘one-size-fits-all’ or ‘blockbuster’ model is now starting to be replaced by personalized medicine that allows for the design of individual targeted treatment based on genetic codes.

Since 2004, the global biomarkers market has seen substantial growth due to factors such as improvements in technology and creation of favorable regulatory norms for application of biomarkers in drug discovery.
3.2.1 High Attrition Rates

With biomarker integration, attrition rates fell by XX% due to correct predictions of drug responses in the early stages of discovery.

The traditional drug discovery process was unable to predict drug failures in the early phases, which led to a high drug attrition rate and fewer approvals. As biomarkers became more integrated, attrition rates fell by XX% due to correct predictions of drug responses in the early stages of discovery, rendering the process efficient, accurate and short. Additionally, the new processes use advanced technologies that can develop novel therapies faster.
4 Biomarkers in Drug Discovery - Market Characterization

4.1 Market Size and Forecasts

The global biomarkers market has seen substantial growth since 2004, due to factors such as improvements in technology and the creation of favorable regulatory norms for the application of biomarkers in drug discovery. Having grown at a Compound Annual Growth Rate (CAGR) of XX%, the market was valued at $XX billion in 2011. The majority of revenue is generated through the application of biomarkers in the discovery, testing and prescription of oncology therapeutics, making it one of the biggest therapeutic areas. The other leading therapeutic areas are Central Nervous System (CNS) and Cardio Vascular System (CVS).

The market is expected to generate $XX billion in 2018 at a CAGR of XX% from 2011.

Table 3: Biomarkers in Drug Discovery, Global Biomarker’s Market, Revenue ($bn), 2004–2011

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Source: GBI Research

Table 4: Biomarkers in Drug Discovery, Global Biomarker’s Market, Revenue Forecast ($bn), 2011–2018

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Source: GBI Research

The biomarkers market was valued at $XX billion in 2004 and rose to $XX billion in 2011 at a CAGR of XX%. With the FDA’s support of the application of biomarkers in drug discovery, the market is expected to generate $XX billion in 2018 at a CAGR of XX% from 2011.
13 Biomarkers in Drug Discovery - Appendix

13.1 Market Definitions

Biomarker: An indicator of biological state used to evaluate normal biological process, pathogenic process, or pharmacological response to a therapy.

Pharmacodynamics: The study of a drug’s effect on the body and MoA of the drug administered.

13.2 Abbreviations

2-PAGE: 2-dimensional PolyAcrylamide Gel Electrophorsis
2D: Two Dimensional
3D: Three Dimensional
AD: Alzheimer’s Disease
ADCC: Antibody-Dependent Cellular Cytotoxicity
ADMET: Absorption, Distribution, Metabolism, Excretion and Toxicity
ALT: Alanine Aminotransferase
AST: Aspartate Aminotransferase
ATP: Adenosine Triphosphate
BCR-ABL: Breakpoint Cluster Region-Abelson
BLA: Biologics License Application
BMS: Bristol-Myers Squibb
CAGR: Compound Annual Growth Rate
CDER: Center for Drug Evaluation and Research
CHAPS: Cholamidopropyl Dimethylammonio Propanesulfonate
CHDH: Choline Dehydrogenase
CIS: Clinically Isolated Syndrome
CLIA: Clinical Laboratory Improvement Amendments
CML: Chronic Myelogenous Leukemia
cMRI: conventional Magnetic Resonance Imaging
CNS: Central Nervous System
CSF: Cerebrospinal Fluid
CT: Computed Tomography
CVS: Cardiovascular System
DHMRI: David H. Murdock Research Institute
DNA: Deoxyribonucleic Acid
EGFR: Epidermal Growth Factor Receptor
ELISA: Enzyme-Linked Immunosorbent Assay
EMA: European Medicines Agency
ESR: Erythrocyte Sedimentation Rate
FDA: Food and Drug Administration
FDG: Fluorodeoxyglucose
FGFR: Fibroblast Growth Factor Receptor
GD: Gadolinium
GHTF: Global Harmonization Task Force
GSK: GlaxoSmithKline
HAART: Highly Active Antiretroviral Therapy
HCV: Hepatitis C Virus
HDL: Health Diagnostic Laboratory
HE: Human Epididymis
HEPES: Hydroxyethyl Piperazine Ethanesulfonic Acid
HER: Human Epidermal Growth Factor Receptor
HESI: Health and Environmental Sciences Institute
HIV: Human Immunodeficiency Virus
HOXB13: Homeobox B13
HTLV: Human T-Lymphotropic Virus
IGFR: Insulin-Like Growth Factor Receptor
IL: Interleukin
ILS: Isogen Life Science
ILSI: International Life Sciences Institute
IND: Investigational New Drug
IVD: In Vitro Diagnostic
IVDMIA: In Vitro Diagnostic Multivariate Index Assay
LDT: Laboratory-Developed Tests
LOI: Letter Of Intent
MAPK: Mitogen-Activated Protein Kinase
MARVEL: Marker Validation for Erlotinib in Lung Cancer
MCI: Mild Cognitive Impairment
MoA: Mechanism of Action
MRE: Magnetic Resonance Elastography
MRI: Magnetic Resonance Imaging
MS: Multiple Sclerosis
NABT: Normal Appearing Brain Tissues
NCCTG: North Central Cancer Treatment Group
NDA: New Drug Application
NIA: National Institute on Aging
NK: Natural Killer
NS5A: Non-Structural 5A
NWG: Nephrotoxicity Working Group
OIVD: Office of In Vitro Diagnostic Device
**PARP 1:** Poly [ADP-ribose] polymerase 1

**PCR:** Polymerase Chain Reaction

**PET:** Positron Emission Tomography

**PI3K:** Phosphoinositide 3-Kinase

**PMA:** Premarket Approval

**PSA:** Prostate-Specific Antigen

**PSTC:** Predictive Safety and Testing Consortium

**PTM:** Post-Translational Modifications

**RA:** Rheumatoid Arthritis

**RBM:** Rules-Based Medicine

**RF:** Rheumatoid Factor

**RNA:** Ribonucleic Acid

**ROMA:** Risk of Ovarian Malignancy Algorithm

**RON:** Recepteur d’Origine Nantais

**SAR:** Structure Activity Relationship

**SELDI-MS:** Surface-Enhanced Laser Desorption/Ionization-Mass Spectrometry

**SNP:** Single Nucleotide Polymorphism

**TE:** Transient Elastography

**TFA:** Trifluoroacetic Acid

**TNF:** Tumor Necrosis Factor

**VEP:** Visual Evoked Potential

**vMRI:** Volumetric Magnetic Resonance Imaging

### 13.3 Bibliography


13.4 Research Methodology

GBI Research’s dedicated research and analysis teams consist of experienced professionals with a pedigree in marketing, market research, consulting backgrounds in the medical devices industry and advanced statistical expertise.

GBI Research adheres to the codes of practice of the Market Research Society (www.mrs.org.uk) and the Strategic and Competitive Intelligence Professionals (www.scip.org).

All GBI Research databases are continuously updated and revised. The following research methodology is followed for all databases and reports.

13.4.1 Coverage

The objective of updating GBI Research’s coverage is to ensure that it represents the most up-to-date vision of the industry possible.

Changes to the industry taxonomy are built on the basis of extensive research of company, association and competitor sources.

GBI Research aims to cover all major news events and deals in the medical industry, updated on a daily basis. The coverage is further streamlined and strengthened with additional inputs from GBI Research’s expert panel (see below).

13.4.2 Secondary Research

Secondary research was carried out on internal and external sources to obtain qualitative and quantitative information in the report.

The secondary research sources that are referred to in this report include but are not limited to:

- Company websites, annual reports, financial reports, investor presentations and SEC Securities and Exchanges Commission filings.
- Industry trade journals, scientific journals and other technical literature.
- Relevant patent and regulatory databases.
- National government documents, statistical databases and market reports.
- News articles, press releases and webcasts specific to the companies operating in the market.

13.4.3 Primary Research

GBI Research conducts hundreds of primary interviews each year with industry participants and commentators in order to validate its data and analysis. A typical research interview fulfills the following functions:

- Provides first-hand information on the market size, market trends, growth trends, competitive landscape, future outlook
- Helps in validating and strengthening the secondary research findings; and
- Further develops the analysis team’s expertise and market understanding.

Primary research involves email correspondence and telephone interviews, as well as face-to-face interviews for each market, category, segment and sub-segment across geographies.

The participants who typically take part in such a process include, but are not limited to:

- Industry participants: CEOs, VPs, marketing/product managers, market intelligence managers and national sales managers;
- Hospital stores, laboratories, pharmacies, distributors and paramedics;
- Outside experts: investment bankers, valuation experts, research analysts specializing in specific medical equipment markets; and
• Key Opinion Leaders: physicians and surgeons specializing in different therapeutic areas corresponding to different kinds of pharmaceutical drugs.

13.4.4 Expert Panel Validation

GBI Research uses a panel of experts to cross-verify its databases and forecasts.

GBI Research’s expert panel comprises marketing managers, product specialists, international sales managers from medical device companies, academics from research universities, KOLs from hospitals, consultants from venture capital funds and distributors/suppliers of medical equipment and supplies.

Historic data and forecasts are relayed to GBI Research’s expert panel for feedback and adjusted in accordance with their feedback.

13.6 Disclaimer

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