Global Fragment-Based Drug Discovery Market to Reach USD 3.2 Billion by 2035, Growing at 10.6% CAGR | TMR

Global fragment-based drug discovery market valued at $1.1B in 2024, set to grow at 10.6% CAGR, reaching $3.2B by 2035

WILMINGTON, DE, UNITED STATES, September 24, 2025 / EINPresswire.com/ -- The pharmaceutical industry is under mounting pressure to innovate faster, reduce development timelines, and address unmet medical needs in areas such as oncology, immunology, and central nervous system (CNS) disorders. In response, Fragment-Based Drug Discovery (FBDD) has emerged as a transformative approach to identify novel chemical starting points for drug development. Unlike traditional high-throughput screening, which evaluates large molecules against target proteins, FBDD focuses on smaller molecular fragments, optimizing efficiency and increasing the likelihood of discovering first-in-class and best-in-class therapeutics.

> FBDD is reshaping drug pipelines with AI, cryo-EM, and novel fragments, enabling faster hit validation, first-in-class targets, and portfolio sustainability."
>
> *Transparency Market Research*

The global Fragment Based Drug Discovery Market was valued at US$ 1.1 billion in 2024 and is projected to grow at a CAGR of 10.6% between 2025 and 2035, reaching US$ 3.2 billion by 2035. Market expansion is driven by regulatory incentives for breakthrough and orphan drugs, rising venture capital investments, and the increasing adoption of sophisticated structural biology techniques such as high-field NMR, X-ray crystallography, and cryo-EM.

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Analysts' Viewpoint on FBDD Market Scenario

Analysts highlight that the growth of FBDD is fueled by both scientific necessity and strategic opportunity. Pharmaceutical and biotech companies are navigating patent cliffs, high R&D costs, and increasing disease burdens. FBDD provides an avenue to explore challenging targets such as protein-protein interactions, allosteric sites, and membrane proteins, which are often intractable with conventional drug discovery methods.

The adoption of FBDD is accelerated by:

Regulatory incentives that promote orphan and first-in-class drug development.
Technological advancements in structural biology and biophysical screening.
Data-driven decision-making, integrating Structure-Activity Relationships (SAR), structural, and biophysical datasets.
Collaborative research models, including CRO partnerships, risk-sharing, and option-to-license agreements.

Modern FBDD programs are leveraging computational modeling, microfluidics, and AI-driven analytics to reduce the design-make-test cycle and optimize lead compounds' ADME (Absorption, Distribution, Metabolism, and Excretion) profiles.

Introduction to Fragment-Based Drug Discovery

Fragment-Based Drug Discovery identifies low-molecular-weight chemical fragments as the starting points for drug development. These fragments, although binding weakly to protein targets, can be elaborated using medicinal chemistry to achieve high-affinity, drug-like molecules.

Key Advantages of FBDD:

Exploration of chemical space: Fragments are smaller and cover diverse chemical space more efficiently than large molecules.
Optimized binding efficiency per atom: Facilitates detection of interactions with challenging targets.
Flexibility in design: Fragments can be grown, merged, or linked to develop potent compounds.
Targeting undruggable proteins: Enables exploration of protein-protein interactions, allosteric sites, RNA targets, molecular glues, and degrader starting points.

Structural biology techniques such as NMR, X-ray crystallography, and cryo-EM are central to FBDD, enabling visualization of fragment binding and guiding rational design. Computational

modeling and biophysical assays complement these approaches to identify, optimize, and validate hits efficiently.

Drivers of the Fragment-Based Drug Discovery Market

High Efficiency and Versatility

FBDD is significantly more efficient than traditional high-throughput screening. Smaller fragment libraries are manageable, cost-effective, and capable of exploring chemical diversity more thoroughly. The process reduces early-stage attrition, decreases time to lead identification, and allows for flexible modifications to enhance potency and selectivity.

The versatility of FBDD enables:

Screening against emerging or difficult targets.
Early integration of translational pharmacology and biomarker strategies.
Rapid optimization of hit fragments into clinically relevant drug candidates.
Innovations in Fragment Libraries

The development of chemically and structurally diverse fragment libraries is a major driver of market growth. Modern libraries include:

Covalent fragments for targeted covalent inhibition.
RNA-targeted fragments for expanding beyond protein targets.
Natural product-like fragments that mimic biologically relevant scaffolds.
Computationally designed libraries optimized with AI and machine learning to predict fragment performance.

Enhanced fragment libraries increase hit quality, accelerate the drug discovery process, and expand the scope of FBDD to previously undruggable targets.

Biophysical Techniques Leading the FBDD Market

Biophysical screening techniques are central to FBDD due to their sensitivity, accuracy, and reproducibility. Leading methods include:

Nuclear Magnetic Resonance (NMR) Spectroscopy – Detects weak binding and provides structural insights.
X-ray Crystallography – Visualizes fragment binding and guides structural elaboration.
Surface Plasmon Resonance (SPR) & MicroScale Thermophoresis (MST) – Quantifies binding kinetics and cooperativity.
Mass Spectrometry (MS) & Isothermal Titration Calorimetry (ITC) – Validates fragment hits and maps interactions.

These techniques allow rapid hit identification, structure-informed optimization, and reliable transition from fragments to lead compounds. Combining biophysical and computational methods enhances throughput, reduces costs, and improves success rates.

Regional Outlook

North America – Market Leader

North America dominated the global FBDD market in 2024 due to:

Presence of well-funded biotech and pharmaceutical companies.
Access to cutting-edge structural biology and computational platforms.
Regulatory support for precision medicine and orphan drug development.
High concentration of CROs, research institutions, and skilled scientists.

The region continues to attract investments, partnerships, and collaborations, solidifying its leadership in global FBDD adoption.

Europe

Europe is witnessing growth through collaborative research and licensing agreements. The region emphasizes structural biology innovation, biophysical screening capabilities, and fragment library development, with notable hubs in the U.K., Germany, and Switzerland.

Asia-Pacific

Asia-Pacific is emerging as a growth hotspot due to:

Expanding pharmaceutical and biotech sectors in China, India, and Japan.
Increasing government initiatives supporting innovation and clinical translation.
Rising adoption of specialized CRO networks for FBDD services.

Latin America and Middle East & Africa

These regions are gradually adopting FBDD through academic collaborations and CRO services, with growth potential tied to emerging biotech ecosystems and investment in drug discovery infrastructure.

Market Segmentation

By Product Type

Fragment Libraries – Core component driving discovery efficiency.
Screening Technologies – Instrumentation, microfluidics, and biophysical platforms.
Software Tools – Computational modeling, AI-driven design, and data analytics.

By Techniques

Biophysical Techniques: NMR, X-ray crystallography, MS, SPR, MST, ITC.
Non-Biophysical Techniques: Fluorescence polarization, capillary electrophoresis, others.

By Application

Oncology – Largest application segment due to high unmet need and molecular complexity.
CNS Disorders – Rising demand driven by neurological disease prevalence.
Infectious Diseases, Cardiovascular, Metabolic Disorders – Moderate growth with increasing interest in novel mechanisms.

By End-User

Pharmaceutical and Biotechnology Companies – Leading adopters for pipeline development.
Contract Research Organizations (CROs) – Provide FBDD services to small and mid-sized firms.
Academic and Research Institutions – Contribute to method development and translational applications.

Competitive Landscape

The FBDD market is competitive, with a focus on platform integration and capability stacking rather than individual assets. Leading strategies include:

Development of automated FBDD studios combining biophysical screening, parallel synthesis, and structural feedback.
Investment in cryo-EM, high-field NMR, microfluidics, and cloud-native ELNs.
Strategic partnerships including risk-sharing collaborations, option-to-license deals, and CRO alliances.
Expansion of fragment libraries with novel scaffolds and AI-guided design.

Key Players:

Thermo Fisher Scientific Inc.
Astex Pharmaceuticals
Domainex
Beactica Therapeutics AB
Charles River Laboratories
Evotec International GmbH

Sprint Bioscience
Structure Based Design, Inc.
Sygnature Discovery Limited
Malvern Panalytical Ltd.
Vernalis (R&D) Limited
SARomics Biostructures
WuXi AppTec
Schrödinger, Inc.
ZOBIO BV

These companies are profiled based on their product portfolios, business strategies, financials, and recent developments.

Key Developments

Enamine & Pohang Accelerator Laboratory (PAL), 2025: Signed an MoU to accelerate hit optimization, integrating fast chemical development with advanced screening technologies to streamline fragment-to-lead progression.
Emerging trends include covalent and electrophile-tuned fragments, structure-guided elaboration, water thermodynamics-informed scoring, and exploration of beyond-rule-of-five chemical space.

The global fragment-based drug discovery market is poised for robust growth through 2035, driven by high-efficiency drug discovery strategies, technological innovation, and collaborative ecosystem expansion. FBDD allows pharmaceutical firms to explore novel targets, shorten development timelines, and identify first-in-class candidates, providing a competitive advantage in the rapidly evolving drug discovery landscape.

With an expected market value of US$ 3.2 billion by 2035, FBDD is set to remain a cornerstone of modern pharmaceutical research, integrating structural biology, computational chemistry, and biophysical technologies to revolutionize how new therapies are discovered.

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