molecular forecaster

COVALENT DRUG DESIGN BUILT ON CHEMISTRY

One size doesn't fit all in covalent docking – sound decisions depend on context. That's why MFI offers a chemistry-first, mechanism-aware, energetics-based approach that models reactions, not only patterns.

Molecular Forecaster Inc. (MFI) is advancing small molecule drug discovery, with human expertise, proprietary software that works like a partner, and an all-in approach to collaboration that sets customers up for success. MFI's software solutions are powered by chemistry-driven predictive tools, seamlessly integrating biophysics and machine learning. This enables tailored experimental design and workflow automation, without the need to rely on third-party applications. Our solutions empower teams to tackle challenges with cutting-edge CADD tools, proven for preclinical drug design.

AN EVOLVING COVALENT LANDSCAPE

Expansion in covalent mechanisms
Covalent mechanisms see consistent clinical use and a meaningful share of approvals across targets

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New opportunities
As covalent design expands past cysteine, evaluation must account for residue identity, reactivity, and selectivity

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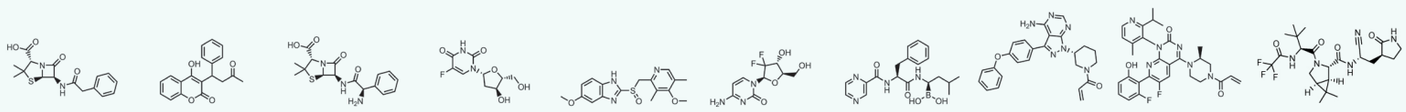
Increasing need for mechanism-aware docking



Penicillin G	Warfarin	Ampicillin	Floxuridine	Omeprazole	Gemcitabine	Bortezomib	Ibrutinib	Sotorasib	Paxlovid
antibiotic	*CMD*	*antibiotic*	*oncology*	*CMD*	*oncology*	*oncology*	*oncology*	*oncology*	*antiviral*
1947	1954	1965	1970	1989	1996	2003	2013	2021	2023

PRODUCT TIMELINE

Research in covalent drug design continues to expand beyond serine, cysteine, and threonine mechanisms, with emerging interest in targeting lysine and tyrosine residues. As mechanistic understanding and technology evolve, new reactive modalities and innovative targets are likely to reshape the landscape, opening possibilities for the next generation of covalent therapeutics.

Serine Cysteine Threonine

MFI'S FITTED COVALENT DOCKING SYSTEM UNLOCKS POWERFUL CAPABILITIES

Chemistry-first	• Encodes mechanisms, not patterns • Ensures stereochemical fidelity from approach to product
Mechanism-aware	• Supports five reaction classes spanning 20+ mechanisms • Models proton transfers, electrophile rehybridization, leaving-group departures, and geometry of attack
Energetics-based	• Chooses covalent or non-covalent binding by energetics, with no forced adducts
Expert-supported	• Medchem: feasibility, SAR, assay input • Program strategy: plans, decision gates, next steps

HOW IT WORKS

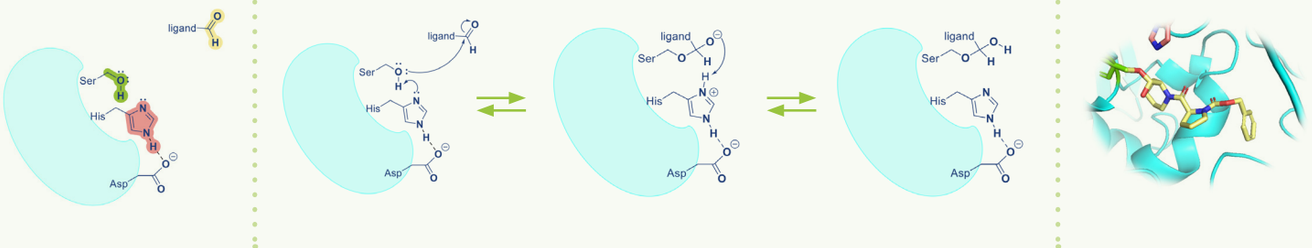
Detect warhead and residue

Assign mechanism

Stimulate reaction geometry and proton transfers

Sample covalent and non-covalent poses

Score and rank

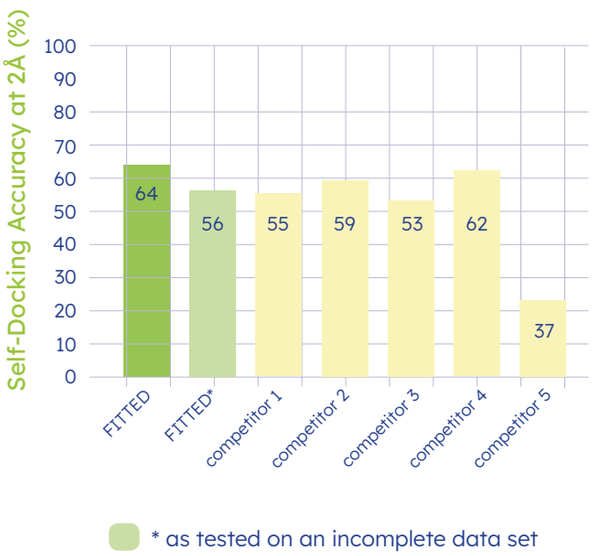


PROVEN RESULTS

FITTED ranked among the top performers across 208 cysteine-bound complexes
(Scarpino et al., 2018)

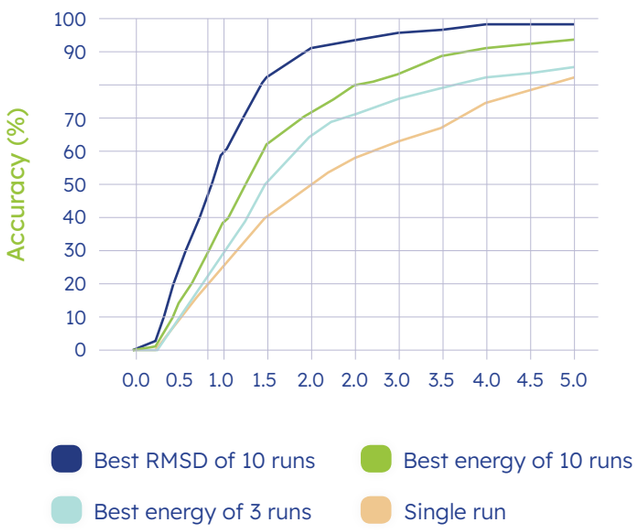
Near-native pose recovered
90% on the Scarpino set

COMPETITIVE LANDSCAPE



* as tested on an incomplete data set

BENCHMARKING PERFORMANCE



DEPLOYMENT

Platforms: Mac, Linux, Windows; local or cloud

Hardware: Laptops for design and SAR; HPC/cluster recommended for ultra-large screen

MORE INFORMATION

Method details (JCIM):
https://pubs.acs.org/doi/10.1021/acs.jcim.1c00701

Case studies:
https://molecularforecaster.com/case-studies/incognito/
https://molecularforecaster.com/case-studies/alchem-laboratories/

Let's talk about how we can support your drug design projects.

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Molecular Forecaster Inc. (MFI) helps organizations make smarter decisions in drug design. We've spent six years democratizing computer-aided drug design via our highly collaborative research-as-a-service model. Today, we're integrating what we've learned into new and improved software tools. Our goal? To become the go-to partner in small molecule drug design, combining proprietary tools and technology, our expertise and know-how, and our all-in approach to collaboration that sets our partners up for success.