

Milliner

Category:

Best Startup

Company Name:

BigHat Biosciences

Turnover and/or Funding:

N/A

Sub-Category:

Biotechnology

Corporate history (creation, key milestones, main funding,...)Information on Condition / Disease and need for solution / product (prevalence, existing treatments / solutions):

BigHat Biosciences was founded on the premise that deep learning's impact on biomedicine lagged behind its impact on high-tech. In biomedicine, AI/ML was primarily used for data analysis at the end of traditional workflows. Co-founders Mark DePristo, from Google AI, and Peyton Greenside, a Schmidt Science Fellow at Stanford, envisioned a lab built to fully integrate AI/ML technologies. They created BigHat in 2019, focusing on designing antibodies through an integrated, high-speed wet lab, which could generate and verify data to improve antibody drugs.

BigHat quickly secured seed funding and developed a platform to engineer antibodies and enhance their characteristics. Joining the MBC Biolabs incubator program in 2019, they built their prototype platform. Following a preemptive Series A funding round led by a16z, BigHat partnered with Amgen, who handed over a troublesome asset that they could not successfully optimize internally. BigHat completed that campaign ahead of schedule by improving the antibody's affinity where traditional methods had failed. This work proved that BigHat's unique closed-loop system - design, synthesize, measure, learn - leveraging machine learning, laboratory automation, and synthetic biology works!

In 2021, BigHat moved to a 30,000 sq ft headquarters in San Mateo, CA, expanding its platform and team. Shortly thereafter, in 2022, BigHat acquired Frugi Biotechnology, boosting their antibody development throughput fivefold. Later that year, BigHat raised

\$80 million in Series B financing led by Section 32, with participation from Amgen Ventures, Bristol Myers Squibb, and others. This funding supported scaling Milliner to handle thousands of new antibody designs weekly, advancing therapeutic programs, and forming strategic collaborations.

Also, in 2022, BigHat partnered with Merck to optimize proteins using Milliner for synthesis, expression, purification, and characterization. Following this, in 2023, BigHat entered a research collaboration with AbbVie to discover and develop next-generation therapeutic antibodies for oncology and neuroscience. In 2024, BigHat teamed up with Johnson & Johnson to guide the design and selection of high-quality antibodies for multiple neuroscience therapeutic targets. Most recently, in 2025, BigHat partnered with Eli Lilly to apply its ML-powered Milliner platform to design next-generation antibodies for up to two programs.

In less than five years, BigHat has developed a powerful AI/ML-enabled biologics platform, partnered with the top global biopharma companies, and built an organization that can support both its internal pipeline and partnership work. Its rapid growth and innovative platform are poised to revolutionize antibody drug development.

History of the development of the solution/product (Intellectual Property, preclinical and clinical datas, development collaborations):

BigHat Biosciences was founded in 2019 with a mission to revolutionize drug discovery by integrating AI/ML technologies into therapeutic research. Co-founders Mark DePristo and Peyton Greenside recognized that while AI/ML was transforming high-tech industries, its impact on biomedicine remained limited, primarily serving as a data analysis tool within traditional experimental workflows. Inspired by their experiences at Google AI and Stanford, Mark and Peyton envisioned a new type of research lab that fully incorporated AI/ML technologies, resulting in the creation of BigHat's integrated, high-speed wet lab focused on antibody design and optimization.

The development of BigHat's platform Milliner was remarkably swift, with seed funding secured just eight weeks post-inception. This initial funding enabled the creation of a prototype platform capable of engineering and enhancing antibodies. By joining the MBC BioLabs incubator program, BigHat refined its platform in a collaborative environment. Their early success was underscored by winning a Golden Ticket from Amgen, which resulted in an initial collaboration. This optimization campaign was completed significantly ahead of schedule in December 2021 and demonstrated BigHat's ability to improve antibody affinity where traditional methods had failed.

In 2021, BigHat expanded from shared bench space at MBC BioLabs to its first global headquarters, a 30,000 sq ft laboratory in San Mateo, CA. This move facilitated increased platform capacity, enabling BigHat to quintuple its antibody development

throughput from 100 to nearly 500 weekly designs. The acquisition of Frugi Biotechnology in January 2022 further enhanced BigHat's capabilities with advanced cell-free protein synthesis (CFPS) reagents, accelerating growth and operational capacity.

In July 2022, following its Series B financing, BigHat significantly expanded the capabilities of its Milliner platform, enabling the design of thousands of antibodies each week. This funding also propelled BigHat's therapeutic programs closer to the clinic and supported the recruitment of world-class drug discovery and development talent. Later that year, BigHat launched a successful collaboration with Merck to optimize up to three protein targets, leveraging its platform to synthesize, express, purify, and characterize each molecule. In 2023, BigHat entered a research collaboration with AbbVie to discover and develop next-generation therapeutic antibodies in oncology and neuroscience. Most recently, in 2024, BigHat partnered with Johnson & Johnson to advance the design and selection of high-quality antibodies targeting multiple neuroscience indications. Most recently, in 2025, BigHat announced a collaboration with Eli Lilly to design and engineer next-generation antibodies for up to two programs, combining BigHat's ML-powered Milliner platform with Lilly's drug discovery expertise.

BigHat takes pride in the speed, efficiency, and accuracy of its Milliner platform. Notably, BigHat has developed its first wave of three wholly-owned therapeutic molecules, which have demonstrated impressive in vivo results and are progressing toward clinical trials to reach patients in need.

Why this drug or device is innovative, the broad implications for future research, and/or how it will improve the human condition:

Unlike most biotech startups that begin by licensing technology from research labs, BigHat invented its platform technologies after its establishment. This organic approach to research and development has led to significant advancements across various scientific fields, including affordable cell-free protein synthesis and novel active learning algorithms. By successfully integrating these technologies into its Milliner platform, BigHat has become a leader in applying AI/ML to drug discovery.

Milliner allows BigHat to develop a unique pipeline of next-generation therapeutics to treat today's most severe diseases. This approach not only reduces the cost and timeline associated with discovering new drugs but also improves patient outcomes by creating more effective treatments. By lowering the development costs for tackling some of the most intractable and expensive diseases, BigHat is poised to reduce the financial burden on healthcare systems and economies worldwide.

BigHat's innovative work has garnered numerous awards and been featured in top trade journals and prestigious AI/ML conferences. The company is pioneering a shift from the traditional empirical approach to drug discovery towards an engineering-based

methodology. This transformation is set to make previously challenging diseases more treatable.

In just a few years, BigHat has established itself as a trailblazer in biotech, fundamentally changing the approach to drug discovery and improving the outlook for patients and healthcare systems globally.

Please provide appropriate references (PubMed, Abstract, Website):

Intros

BigHat 2 min overview video: <https://www.youtube.com/watch?v=KVe65wxLyU0>

BigHat non-confidential deck: <https://bighat.docsend.com/view/s7wc86gedk52tsjr>

Antibody Engineering and Therapeutics 3Q23 talk:

<https://www.bighatbio.com/news/bighats-cso-presents-at-antibody-engineering-and-therapeutics-conference-europe-2023>

Pitchbook profile: <https://pitchbook.com/profiles/company/366556-33>

Publications

Effective Surrogate Models for Protein Design with Bayesian Optimization:

https://icml-compbio.github.io/2021/papers/WCBICML2021_paper_61.pdf

Accelerating Bayesian Optimization for Biological Sequence Design with Denoising Autoencoders: <https://proceedings.mlr.press/v162/stanton22a.html>

Inverse Protein Folding Using Deep Bayesian Optimization:

<https://arxiv.org/abs/2305.18089>

Antibody Design with Constrained Bayesian Optimization:

<https://openreview.net/pdf?id=K5Sr6WSA4B>

Generative Humanization for Therapeutic Antibodies:

<https://openreview.net/pdf?id=LiQUkaawXI>

Disclosed partnerships

BigHat and Eli Lilly 2Q25:

<https://www.bighatbio.com/news/bighat-biosciences-and-lilly-collaborate-to-advance-ai-driven-antibody-therapeutics>

BigHat and J&J 2Q24:

<https://www.bighatbio.com/news/bighat-biosciences-enters-into-strategic-collaboration-to-leverage-machine-learning-in-antibody-discovery-design>

BigHat and AbbVie 4Q23:

<https://www.bighatbio.com/news/abbvie-and-bighat-biosciences-announce-research-collaboration-to-leverage-artificial-intelligence-and-machine-learning-to-discover-next-generation-therapeutic-antibodies>

BigHat and Merck 4Q22:

<https://www.bighatbio.com/news/bighat-biosciences-announces-research-collaboration-with-merck>

BigHat and Amgen 1Q22:

<https://www.bighatbio.com/news/bighat-biosciences-completes-first-stage-of-research-collaboration-with-amgen>

Financing

Section 32-led \$75M Series B:

<https://www.bighatbio.com/news/bighat-raises-75m-series-b>

a16z-led \$19M Series A: <https://www.bighatbio.com/news/bighat-raises-19m-series-a>

8VC-led \$5M seed:

<https://www.bighatbio.com/news/bighat-closes-oversubscribed-seed-round>

Media

CBI's Digital Health 50 4Q23:

<https://www.cbinsights.com/research/report/digital-health-startups-redefining-healthcare-2023/>

GenEng News 4Q23:

<https://www.genengnews.com/topics/artificial-intelligence/ai-created-antibodies-drive-innovation-at-bighat-biosciences/>

Life Science Catalyst award 4Q23:

<https://www.businesswire.com/news/home/20221028005079/en/Biocom-California-Announces-Seventh-Annual-Life-Science-Catalyst-Award-Winners>

Biocom CA's Lifelines Podcast 3Q23:

<https://www.biocom.org/lifelines/podcast/episode-9-peyton-greenside-co-founder-and-cso-bighat-biosciences/>

BI's Most promising generative-AI startups of 2Q23:

<https://www.businessinsider.com/most-promising-generative-artificial-intelligence-startups-according-vcs-venture-capital-2023-3>

FinTech TV 1Q23:

<https://www.fintech.tv/News/Detail/7377-better-biologies-through-ai-guided-design%E2%80%A6>

Fierce Biotech 4Q22:

<https://www.fiercebiotech.com/biotech/exclusive-bighat-cherry-picking-opportunities-amid-stormy-market-pens-pact-big-pharma-merck>

Fierce Biotech 3Q22:

<https://www.fiercebiotech.com/biotech/bighat-protects-against-stormy-market-conditions-big-pharmas-joining-80m-series-b>

AWS Summit 2Q22:

<https://www.bighatbio.com/news/bighats-cso-and-vp-engineering-speaking-at-aws-summit-san-francisco>

Pharma's Almanac 1Q22:

<https://www.bighatbio.com/news/bighat-in-pharmas-almanac-q1-2022-issue>

BIOS Builders 1Q22:

<https://www.bighatbio.com/news/bighats-ceo-and-cso-on-bios-builders-podcast>

References File Document upload:

N/A