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Contents

EMERGING TECH RESEARCH

SynBioBeta Recap

GenAI transforming synthetic biology into digital biology

PitchBook is a Morningstar company providing the most comprehensive, most accurate, and hard-to-find data for professionals doing business in the private markets.

Key takeaways

- The promise of AI and digital biology dominated discussions at SynBioBeta 2024.
- Biopharma remains a strong sector within SynBio, driving funding through high-impact investments and larger exits such as IPOs and M&A despite a post-pandemic shift toward fewer, larger deals.
- Industrial biotech has struggled with investment due to low exit activity and profitability, with a need for stronger data to de-risk the science.
- AI and digital biology are focusing on generative AI reshaping investments, with advancements in protein folding and drug discovery highlighted by the introduction of tools such as AlphaFold 3.
- Life science tools & services funding is more selective, focusing on later-stage companies with scalable and profitable products. Innovation in tools such as DNA synthesis, proteomic characterization, and single-cell genomics is critical but challenging due to the capital-intensive nature of R&D.
- In bioeconomy, the emphasis is on the need for scalable biomanufacturing solutions and advanced life science tools to reduce costs and improve efficiency in product or drug development.
- Psychedelics has increased attention on the integration of synthetic biology with psychedelic therapies, considering the unique regulatory and scientific challenges.
- In longevity, interest in cell and gene therapies grows for applications in antiaging therapeutics, discussed as a burgeoning field with potential for transformative health outcomes despite facing long timelines and shifting regulations.

Introduction

The SynBioBeta 2024 conference, the premier annual event for the synthetic biology (SynBio) industry, was held from May 6 to 9 in San Jose, California. The event brought together an estimated 2,000 attendees, including researchers, industry leaders, investors, and policymakers, to discuss the latest advancements and trends in life science tools, biopharma, AI, climate change, industrial bio, and other topics. The key themes this year were Human Health, Tools & Technology, Planetary Health, and Business of Biology & Society. Keynote speakers included Vinod Khosla, a top Silicon Valley VC investor and a winner of the SynBioBeta Lifetime Achievement Award; Stephen Quake, Stanford professor, Head of Science at the Chan Zuckerberg Initiative, and founder of numerous successful SynBio startups; Craig Venter, founder of the J. Craig Venter Institute and early leader in human genome sequencing; and Stephen Wolfram, founder of Wolfram Research and one of the original AI leaders. The conference tends to cater more toward early-stage innovations with founder-led startups, tech biology (TechBio) investors,[1] and corporates with pharma and biotech services. This is in stark contrast to the J.P. Morgan Annual Healthcare Conference, which focuses on late-stage and clinical biotech companies hoping to exit via IPO, along with established public pharma and biotech companies. Much of the SynBio space is still in its early stages, with few notable IPOs aside from biopharma cell and gene therapy players and life science tools companies such as Ginkgo Bioworks, Twist Bioscience, and Absci.

Investment health

The SynBio industry is a mixed bag in terms of investment health, with various components including biopharma, industrial biology, agricultural technology, and digital biology. Biopharma is seen as the leading force in the space, and as highlighted in our Q4 2023 Biopharma Report, the sector is holding fast in a new normal post-pandemic, with concentrated deals.

Post-pandemic, the biopharma funding landscape has shifted, with fewer but larger deals focusing on high-impact investments. Economic conditions driven by federal interest rates created a new normal in terms of funding volumes that has stabilized since last year. Biopharma leads in SynBio funding due to high returns from larger exits such as IPOs and M&A, driven by clinical trials data rather than sales. Life science tools & services struggles to secure funding, slowing growth and innovation. Industrial biotech faces challenges in securing investments due to poor exit activity and profitability. Deals are taking longer because investors need stronger data to de-risk the science and are searching for those with new funds rather than those reserving capital for current portfolios. AI investments are driven by new datasets from generative AI (GenAI), shifting focus from small molecules to biologics, with new tools such as high-throughput experimentation for protein binding emerging in proteomics.

1: In TechBio, engineering meets biology to solve problems through programming and design. Founder-led companies create platform technologies for rapid drug discovery, leveraging AI, automation, and computation.

The financing environment is increasingly concentrated across SynBio, with investments focusing on later-stage companies with profitable products to scale or late-stage clinical data closer to approval. Superior technology and services are crucial for attracting investment in the tools space as a universal standard. Investors look for opportunities that align with market needs, where founders understand customer key performance indicators and can build their minimum viable product with seed funding. This contrasts with startups developing products that require research & development (R&D) well past Series A before any sales, which is a major concern for innovative life science tools that can really move the industry in spaces such as proteomic characterization or single-cell genomics. Additionally, new tech or tool services to aid SynBio are not favored as well as existing products but are poised to make a comeback, which will be highlighted in our upcoming pharmatech vertical launch.

Much discussed at the conference was sustainable funding for scientific research in SynBio, which requires innovative organizational models. Integrating AI and automation is vital for advancing research and reducing costs. Balancing public and private sector involvement ensures a stable funding environment, with public sector support providing foundational research funding and private investment driving commercialization and scaling. Entities such as Schmidt Futures, the group presented in a policy panel, become critical to fund the areas unmet by investor or government interests, which are mainly in industrial bio due to the lack of investment exits or commercial success despite urgent needs in climate change. Other emerging entities trying to change the funding dynamics include the focused research organizations trying to develop new "moonshot" science over longer time horizons without worry of revenue. For example, FutureHouse, which is funded by former Google CEO Eric Schmidt, is a focused research organization developing an AI scientist platform to transform how research is done.

Successful biotech investment strategies involve finding clients, building partnerships, and developing clear investment strategies. Challenges in bio production and the emergence of AI-enabled contract services are significant considerations. For example, at the conference, Emerald Cloud Lab revealed it is using AI with its automated labs to design experiments, while other companies such as Quantum Sky are providing the generative and quantum AI models for clients developing therapeutics. Developments in genomics and CRISPR technology continue to attract interest and investment despite the lack of clinical success, which is slowing investor interest and shifting the focus to funding life science tools & services startups such as Elegen and Ansa Biotechnologies for enabling rapid, larger, and more accurate DNA synthesis. However, for therapeutics, SynBio-driven longevity bets are getting attention, including Loyal, which focuses on enabling dog antiaging therapeutics, and bit.bio, which is developing the next generation of programming stem cell therapies. Other companies discussed at the conference include Light Bio and Senseory, which are engineering house plant products for night lighting or smell, respectively.

AI biotech and digital biology

AI was a dominant theme at the SynBioBeta conference, which was held near the AI-obsessed Silicon Valley. Throughout, the conference delved into AI, from keynotes and fireside chats to talks, numerous panels, and hallway conversations. Much of the discussions continued to build upon the hype from the J.P. Morgan conference, as well as the ongoing AI rebranding of biotech plays. The term "digital biology" is being used to describe the industry as it advances with GenAI technologies. We looked at it as a branding effort to differentiate GenAI-powered startups from the previous wave of artificial intelligence & machine learning biotech or TechBio startups. Current market trends align with our 2024 Healthcare Outlook, suggesting sustained interest and investments despite the economic downturn. Investors are keen on strategies that leverage these technologies for long-term gains, anticipating substantial returns as the field matures.

AI model development presents significant opportunities in protein folding, multimodal modeling, and drug discovery, although challenges in data generation, quality, and integration persist. These hurdles may be more dependent on life science hardware and reagent innovations. In one of the GenAI panels, Boris Power, Head of Research at OpenAI, emphasized scalability and predictive capabilities for modeling diverse modalities and predicting properties of proteins, ligands, and DNA/RNA. In his keynote, Vinod Khosla noted AI's potential to make diagnostics faster, more accurate, and more accessible. Other speakers highlighted the impact of GenAI on the SynBio operating system, making the code of life programmable and thus truly enabling digital biology. Many of these similar promises to engineer or code biology were made over the decades since genetic engineering and systems biology began with Genentech at the end of 1970s. Hence, there is always some skepticism, despite the significant advances in biology and software tools, on the hype-startup marketing that drives massive valuations.

In terms of major advances, the unveiling of the new AI model AlphaFold 3 has significant implications for protein-based therapeutics, marking a milestone in biological research and drug discovery. With the AlphaFold 3, Google DeepMind and Isomorphic Labs aim to transform the understanding of biology through advanced structural prediction capabilities. Other innovations presented at the conference include Absci's generative antibody design, LabGenius' AI-powered discovery, Dyno Therapeutics' GenAI for gene therapy viral vector design, and Cradle Bio's AI enzyme engineering. Open-source AI tools, such as 310.ai's molecule design tools, InstaDeep's DeepChain for protein design, and Ginkgo Bioworks' Lab Data as a Service offering, are democratizing access to advanced AI tools, fostering innovation and collaboration across the biotech landscape from industry to academic labs. However, as mentioned in our latest biopharma report, the lack of winners on the biopharma end with AI and small molecules is a concern, despite renewed interest due to AI advancements and a focus on biologics. Investors will invest in next-generation tech regardless of success on previous tech in hopes that the new tech may solve the hurdles or lack of major progress.

Select investments in AI biotech and digital biology*

Company	HQ location	Last known valuation ($M)	Total raised ($M)	Last financing deal type
Shiru	Alameda, US	$59.0	$20.7	Early-stage VC
Vevo	South San Francisco, US	$40.0	$12.0	Accelerator/incubator
Ganymede	Palo Alto, US	$60.2	$15.2	Early-stage VC
Emerald Cloud Lab	Austin, US	$450.6	$152.1	Secondary transaction - private
Constructive Bio	Saffron Walden, UK	$19.8	$15.7	Seed round
EvolutionaryScale	New York, US	$200.0	$40.0	Seed round
LabGenius	London, UK	$52.8	$72.8	Late-stage VC
Biomatter	Vilnius, Lithuania	N/A	$0.6	Late-stage VC
Cradle	Delft, Netherlands	N/A	$29.5	Early-stage VC

Source: PitchBook • Geography: Global • *As of June 3, 2024

Bioeconomy infrastructure tools and services

The bioeconomy spans diverse areas including contract R&D services, gene synthesis tools, and manufacturing. Common challenges such as scalability and cost significantly impact these sectors. Growth in this area is vital for producing essential medicines efficiently and reducing development costs. Recent panel discussions at SynBioBeta highlighted the critical roles of demand, production capacity, and industrial strains in scaling biomanufacturing. Investors noted the need for adequate funding and exit strategies, pointing out that many industrial bio startups lack profits and growth despite having innovative products.

Key hurdles include the biological risks and the challenge of scaling engineered processes. Solutions involve adopting advanced bioprocessing technologies, automation, and integrating digital tools for production monitoring and control. Additionally, companies such as Antheia are rethinking pharmaceutical supply chains by using engineered yeast to mitigate drug shortages, emphasizing the need for a restructured approach to meet medical demands.

On the tools side, DNA synthesis is a cornerstone of SynBio, as it enables substantial advancements across medicine, agriculture, and climate change. This area continuously seeks faster turnarounds at scale and greater accuracy, which are critical as synthesized DNA uses shift from labs to clinics in cell and gene therapy. Adjacent to this is the need for multiomics methods, with companies such as SPOC Proteomics and BioLoomics working to scale up characterization to engineer protein or cell systems faster. Investors seek these types of startups more so due to the

hopes of generating new datasets to feed GenAI models, but tools have been a winner-take-all market due to the superior products monopolizing users and clients. Therefore, the technologies must demonstrate 10x value in speed, scale, costs, or enabling new science, alongside strong defendable patents.

Looking forward, other tools are needed to enable new parts of biology to be engineered in the SynBio way. One example is developing neurotech for exploring the gut-brain axis for microbiome engineering. Another example is in space biology, where space exploration presents unique challenges for the bioeconomy. These challenges include long-duration spaceflight issues such as radiation, isolation, and confinement, which require tools tailored for extreme conditions.

Select investments in life science R&D tools*

Company	HQ location	Last known valuation ($M)	Total raised ($M)	Last financing deal type
Nuclera	Impington, UK	$154.5	$79.1	Late-stage VC
SPOC Proteomics	Menlo Park, US	N/A	$25.0	Early-stage VC
DNA Script	Le Kremlin-Bicêtre, France	$659.7	$294.0	Late-stage VC
Elegen	San Carlos, US	$100.0	$56.6	Late-stage VC
Ansa Biotechnologies	Emeryville, US	$203.0	$82.7	Early-stage VC
Sampling Human	Berkeley, US	N/A	$4.5	Late-stage VC
Ribbon Biolabs	Vienna, Austria	N/A	$22.2	Late-stage VC
Asimov	Boston, US	$1,225.0	$204.7	Late-stage VC
Watchmaker Genomics	Boulder, US	$230.0	$48.3	Early-stage VC
BioLoomics	Boulder, US	$22.3	$10.2	Seed round

Source: PitchBook • Geography: Global • *As of June 3, 2024

Biopharma cell and gene therapy, psychedelics, and longevity

The biopharma sector in SynBio is marked by market fragmentation, profitability, and significant expansion potential. Investors are keen on diverse strategies that encompass operational models and tackle challenges in manufacturing and delivery. Cell and gene therapies stand out, with AI playing a crucial role in addressing genome complexity, enhancing safety, and navigating regulatory landscapes. CAR-T therapies have matured and garnered more interest in SynBio methods for engineering cells. Companies such as bit.bio are pioneering the development of induced pluripotent stem cell (iPSC) lines to explore disease causes and cellular functions. This technology, rooted in Shinya Yamanaka's Nobel Prize-winning work on cell reprogramming, allows scientists to study how genomes enable cellular identities and functions. However, these therapies face substantial hurdles in manufacturing and delivery, demanding innovative solutions to realize their full potential. Due to the potential, investors are still willing to risk the capital, with over $100 million raised for bit.bio so far.

The intersection of SynBio and psychedelic therapies represents the next frontier in medicine, as noted by the keynote by Paul Stamets of Fungi Perfecti and MycoMedica Life Sciences. Stamets and other panel experts discussed the differences between synthetic and natural compounds in psychoactive therapies, emphasizing the therapeutic benefits of natural products despite regulatory preferences for synthetics. Investors believe synthetic compounds, with their rigorous profiling, offer a deeper understanding of psychoactive effects and precision medicine. A collaborative approach between the scientific community and traditional healers was suggested to unlock the full potential of these therapies. However, the lack of patentability in this space is holding back traditional biotech investors, who may view it similarly to cannabis innovations.

Longevity therapeutics, which was the core of Vinod Khosla's keynote, is another exciting area within SynBio that offers profound insights into disease mechanisms and potential treatments. Examples from Khosla's portfolio include Loyal's work on developing the first longevity drug for dogs, which exemplifies the practical applications of this research, and eGenesis using pig kidney transplants to address human organ supply issues. The main hurdle has been the timeline for aging-disease clinical trials to determine success, as venture funds usually have short time horizons, which startups such as Gordian Biotechnology hope to solve with its speedy gene therapy discovery platform. Long-term financing strategies are needed in the longevity space. Additional groups such as VitaDAO at SynBioBeta emphasized the need to educate investors, academics, and society about this field to encourage more funding. They also aim to aid the initial financing of longevity research with their token financing model.

Select investments in biopharma and pharmatech*

Company	HQ location	Last known valuation ($M)	Total raised ($M)	Last financing deal type
bit.bio	Cambridge, UK	$582.6	$201.1	Accelerator/incubator
eGenesis	Cambridge, US	$350.0	$288.4	Late-stage VC
Gordian Biotechnology	San Francisco, US	$170.0	$60.0	Late-stage VC
Integra Therapeutics	Barcelona, Spain	$12.7	$6.8	Seed round
Metaphore	Cambridge, US	N/A	$50.0	Early-stage VC
Cellino	Cambridge, US	$140.0	$99.7	Late-stage VC
Loyal	San Francisco, US	$291.3	$114.3	Late-stage VC
Pearl Bio	Cambridge, US	$13.1	$4.1	Grant
Antheia	Menlo Park, US	$270.0	$134.7	Late-stage VC
MycoMedica Life Sciences	Shelton, US	$305.9	$63.3	Early-stage VC

Source: PitchBook • Geography: Global • *As of June 3, 2024