

Startup Company Memo

Subject: Building the World's First AI-Native "Dark Factory" for Biopharma manufacturing

Name: Mustard Life Sciences, Riverside, California

Website: <https://mustardbio.com>

Overview

The US/Europe imports roughly 80% of the medicines it consumes from China and India due to high cost of domestic manufacturing. To fix this, we are building an **AI-native autonomous manufacturing ecosystem** to make domestic manufacturing of medicines cheaper.

We are applying the "dark factory" concept which was pioneered by FANUC in Japan and widely used in advanced Chinese EV manufacturing to pharmaceutical production by developing fully autonomous, software-orchestrated facilities capable of operating continuously with little to no manual oversight.

Our goal: **10x faster and 30x cheaper production compared to existing factories**, enabling affordable, accessible medicines globally.

Tags: Manufacturing, Deeptech, Life sciences, Pharma 4.0, Industry 5.0, Dark Factories, Biopharma, CDMO, IDMO, CMO, AI, ML, Renewable energy

The Core Problem

Pharma manufacturing today is:

- Slow (~12–18 month lead times)
- Capital intensive (millions upfront for small batches)
- Operationally inefficient (30–40% lost capacity annually)
- Fragmented across various disconnected factories
- Creating fragile centralized supply chains of medicines

Our Solution: The Autonomous Pharma "Dark Factory"

We are building the world's first Autonomous biopharma Smart 'Dark' Factory which a fully software-defined, AI- native pharmaceutical manufacturing ecosystem that autonomously controls the machines and orchestrates the production process, converting raw materials into finished medicine batches with minimal human intervention. It is a vertically integrated

manufacturing architecture we designed from the ground up to control all manufacturing and quality activities with intelligent software. Our proprietary software is called Factory OS.

Factory OS will control two hardware forms:

A smart factory hub for mass production: Our large-scale, renewable-powered hub running on the proprietary software for making high-volume medicines at scale

Mobile mini-factories: Easily deployed, renewable-energy powered, containerized manufacturing pods for low-cost, small-batch, rapid supply at point-of-need (e.g. Clinical trial sites, pandemic control centers, healthcare centers, research labs and hospitals)

Factory OS is a unified operating system that autonomously orchestrates:

- Bioreactor operation
- Upstream/Downstream/Fill-Finish manufacturing processes
- In-line quality testing and systems
- Process monitoring
- Environmental controls
- Factory administration
- Supply chain inputs
- Analytics & predictive maintenance
- Regulatory compliance

Unlike traditional factories that rely on multiple siloed software systems, individual machine automation and heavy human oversight, Mustard's platform eliminates a lot of these bottlenecks. We are setting the stage for Pharma 5.0, working from first principles and taken to its logical reengineered conclusion by adapting the efficiency methods seen in Chinese industrial dark factories for regulated pharmaceutical environments.

Products and Services

Products: We are making specialized medicines like

- Biosimilars (e.g., monoclonal antibodies)
- Anti-Cancer, rare diseases and orphan drugs
- High-need generics (tablets, capsules, injectables)

Services

- Manufacturing-as-a-Service (MaaS) – Contract manufacturing for clients
- Research-as-a-Service (RaaS)
- Mini-factory leasing (Future)

Market Opportunity

- \$571B global biopharma market (2023)
- Projected \$1.18T by 2032
- \$95B addressable biosimilars & generics segment
- Outsourced pharma manufacturing growing at 13% CAGR
- An undisrupted industry sector

Competitive Positioning

Legacy players like Pfizer, Lonza, WuXi Biologics, Catalent, and Samsung Biologics operate large-scale facilities that rely on conventional operational models.

Mustard differentiates through:

- Autonomous end-to-end process control
- AI-native architecture (not retrofitted automation)
- Single manufacturing control layer
- Renewable-powered infrastructure
- Software defined manufacturing
- Faster and cheaper medicine production

Why This Matters

When successful, we will:

- Compress drug production timelines from months to days
- Reduce cost of producing medicines dramatically leading to more affordable medicines and increased medicine accessibility globally
- Decentralize pharmaceutical supply chains
- Reshore pharma manufacturing to increase domestic production of medicines
- Set the standard for autonomous pharma manufacturing globally

Team:

Samuel Ojeabulu (CEO): A manufacturing scientist (pharm) and an electro-mechanical engineer with interest in software engineering. He has worked in the life science manufacturing industry across continents, setting up 12+ factory projects for big pharma clients that include GSK and Regeneron.

Ebuka Eze (CTO): Experienced full stack software engineer with extensive background in software development with AI/ML specialization. He has two other software engineers working with him at Mustard.

Dunsin Adeoye: Our embedded systems engineer. He is an electrical/electronics engineer with experience in IoT systems, machine automation, sensor suites and frontend software engineering

Professor Anyakora (Strategic Advisor): He is a distinguished figure with over 25 years experience across drug development, public health, pharmaceutical market access and extensive manufacturing expertise. His career spans academia, high impact public health programs, and private sector leadership.

Traction:

- Signed Letter of Intent (LOI's) with interested pharma clients worth 300k USD
- Tested the first version of MVP software by integrating it with pharma manufacturing machines to achieve ~25% increased efficiency
- Secured factory space for pilot plant
- Signed a lease with Murrieta Innovation Center, Riverside, California

Funding: We are seeking \$1.3M in pre-seed funding

Use of funds

1. Buildout our lab factory, install equipment, integrate OS and begin pilot production. This enables us to convert our LOI's to revenue
2. Increase staff strength (two additional engineers and two process scientists)

Join us in building the future of biopharma manufacturing. Let's talk!

Contact Details

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