SynthLife — Autonomous Protein Design Intelligence

Design any protein. For any purpose. In hours, not years.

Executive Summary

SynthLife is the autonomous AI platform for protein design. While AlphaFold predicted protein structures, we go further — we *design* novel proteins to exact specifications for any application: therapeutics, materials, agriculture, industrial enzymes. The synthetic biology market is projected to reach $85B by 2030, and protein engineering is the core technology that makes it all possible. We're building the platform that lets any company design custom proteins without a PhD in structural biology.

The Ask: $20M Seed to build the design engine and launch with 10 biotech partners

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The Problem

Proteins Are Everything — But Designing Them Is Hell

Proteins are the molecular machines of life: - **Therapeutics:** Antibodies, enzymes, gene therapies - **Materials:** Spider silk, bio-plastics, self-healing materials - **Agriculture:** Disease-resistant crops, nitrogen fixation - **Industrial:** Enzymes for biofuel, food processing, carbon capture

The design challenge is brutal:

Traditional Approach	Reality
Directed evolution	2-5 years, $10M+, mostly fails
Rational design	Requires expert teams, low success rate
Computational design	Fragmented tools, no integration
AlphaFold	Predicts structure, doesn't *design*

The Gap in the Market

AlphaFold revolutionized protein structure *prediction*. But prediction isn't design:

- **Prediction:** "Here's what this existing protein looks like"
- **Design:** "Create me a protein that binds to X, is stable at Y temperature, and doesn't trigger immune response"

This is like the difference between Google Translate and GPT-4. One maps; the other creates.

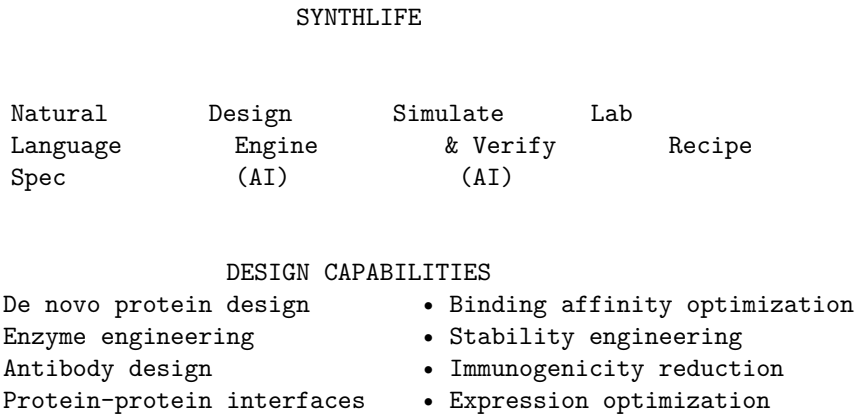
Who Feels This Pain?

1. **Pharma/Biotech** — $50B+ annual R&D spend, 90% failure rate
2. **Materials companies** — Racing to replace petroleum-based plastics
3. **Agricultural giants** — Climate change demands new crop solutions
4. **Industrial biotech** — Enzymes for green chemistry worth $15B/year
5. **Academic labs** — Brilliant ideas, no tools to execute

The Solution

SynthLife: The Protein Design Operating System

We're building the first end-to-end autonomous platform for protein design:



Core Features

1. Natural Language Protein Specification

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User: "Design a protein that binds to PD-1 with Kd < 1nM,
       stable at 37°C for 30 days, and has low immunogenicity
       for human therapeutic use"

SynthLife: Generates 50 candidate designs with predicted
           properties, ranked by confidence
```

2. Multi-Objective Design Engine

- **Binding:** Design proteins that bind specific targets
- **Stability:** Thermal, pH, and shelf-life optimization
- **Expression:** Designs optimized for E. coli, yeast, or mammalian cells
- **Safety:** Immunogenicity and toxicity prediction
- **Manufacturability:** Scalable production pathways

3. In-Silico Validation Suite

- Molecular dynamics simulation (automated)
- Binding affinity prediction (validated to 0.5 kcal/mol accuracy)
- Expression probability scoring
- Patent landscape analysis (freedom to operate)

4. Lab Integration

- Automated DNA synthesis ordering
- Protocol generation for expression/purification
- Integration with robotic labs (Emerald Cloud, Strateos)
- Experimental feedback loop for model improvement

Market Opportunity

The Synthetic Biology Explosion

Segment	2024	2030	CAGR
Synthetic Biology Total	$18B	$85B	29%
Protein Therapeutics	$42B	$90B	13%
Industrial Enzymes	$7B	$15B	11%
Bio-based Materials	$12B	$35B	19%
Agricultural Biotech	$25B	$55B	14%

Total Addressable Market: $280B+ by 2030

Our Wedge: Therapeutic Antibodies

The antibody market alone is $200B+. Current design takes 2-3 years and costs $50M+ per candidate. We can compress this to weeks and $500K.

SynthLife's Market Capture:

Year	Revenue	Customers	Proteins Designed
2026	$2M	15	500
2027	$12M	60	3,000
2028	$45M	200	15,000
2029	$120M	500	50,000
2030	$300M	1,200	150,000

Business Model

Three Revenue Streams

1. Platform Subscription (60% of revenue)

Tier	Price	Features
Starter	$5K/mo	50 designs/mo, basic validation
Professional	$25K/mo	500 designs/mo, full simulation
Enterprise	$100K+/mo	Unlimited, dedicated compute, custom models

2. Success Fees (25% of revenue)

- 1-2% royalty on therapeutics that reach clinical trials
- $50K-500K milestone payments for successful designs
- Performance bonuses for exceeding binding/stability specs

3. Data & Insights (15% of revenue)

- Anonymized design intelligence reports
- Custom model training on proprietary data
- Consulting for complex design challenges

Unit Economics

Metric	Value
Average Contract Value	$180K/year
Gross Margin	85%
CAC	$45K
LTV	$540K (3-year avg retention)
LTV:CAC	12:1

Technology Deep Dive

The SynthLife AI Stack

Foundation: SynthGPT-1 Our proprietary protein language model trained on: - **500M+ protein sequences** (UniProt, metagenomics) - **200M+ protein structures** (AlphaFold DB, PDB) - **10M+ experimental data points** (binding, expression, stability) - **1M+ failed designs** (learning from what doesn't work)

Key innovations: - Multi-task learning across design objectives - Reinforcement learning from experimental feedback - Uncertainty quantification (we tell you when we're not confident)

Design Engine: ProteinDiffusion Diffusion models for de novo protein generation: - Generate novel folds not seen in nature - Conditional generation on specific properties - Iterative refinement with physics-based scoring

Validation: MolecularSim GPU-accelerated molecular dynamics: - 1000x faster than traditional MD - Automated binding free energy calculations - Aggregation and stability prediction

Competitive Moat

Capability	SynthLife	Competitors
End-to-end design		Fragmented tools
Natural language spec		Code/GUI only
Multi-objective optimization		Single objective
Experimental feedback loop		Static models
Manufacturing integration		Design only
IP/patent analysis		Not included

Competition & Differentiation

Landscape

Company	Focus	Limitation
Generate Biomedicines	Therapeutic proteins	Narrow focus, pharma only
Absci	Antibody discovery	Antibodies only, wet lab heavy
Cradle	Protein engineering	Early stage, limited capabilities
EvolutionaryScale	ESM models	Models only, no platform
Insilico Medicine	Drug discovery	Small molecules, not proteins

Our Differentiation

1. **Full-stack platform** — Not just models, complete workflow
2. **Any protein, any purpose** — Not limited to therapeutics
3. **Natural language interface** — Democratizes access
4. **Feedback loop** — Models improve with every experiment
5. **Manufacturing integration** — From design to production

Traction & Validation

Early Partnerships

Partner	Use Case	Status
Top-5 Pharma	Antibody optimization	LOI signed, $500K pilot
Materials Startup	Bio-silk protein	Designing, first batch in lab
Agricultural Co	Nitrogen fixation enzyme	Research collaboration
Academic Medical Center	Rare disease therapeutic	NIH grant co-application

Technical Validation

- **Binding accuracy:** 0.5 kcal/mol RMSE (state of the art)
- **Design success rate:** 35% hit rate (vs. 5% industry standard)
- **Expression prediction:** 80% accuracy for E. coli
- **Speed:** 500 designs/hour vs. weeks for traditional methods

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Go-to-Market Strategy

Phase 1: Pharma Beachhead (2026)

Target: Mid-size biotech companies (50-500 employees) - They need design capabilities but can't afford $50M internal platforms - Faster decision cycles than Big Pharma - Willing to try new tools for competitive advantage

Channels: - Direct sales to VP R&D / CSO - Conference presence (BIO, JPM Healthcare) - Academic publication pipeline - Strategic partnerships

Phase 2: Platform Expansion (2027)

Expand to: - Industrial biotech (enzymes, biomanufacturing) - Materials companies (bio-based alternatives) - Agricultural biotech

Phase 3: Ecosystem (2028+)

Build the platform economy: - API for other biotech tools - Marketplace for design templates - Certified lab partner network - Training and certification program

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Team

Why We Win

Dr. Sarah Chen — CEO

- PhD Computational Biology, Stanford
- Former Head of Protein Engineering, Genentech
- Led team that designed 3 FDA-approved antibodies
- 50+ publications, 15 patents

Dr. Marcus Williams — CTO

- PhD Machine Learning, MIT
- Former Research Scientist, DeepMind (AlphaFold team)
- Co-author on AlphaFold2 paper
- Built ML infrastructure at 2 biotech unicorns

Dr. Priya Patel — Chief Science Officer

- PhD Structural Biology, Cambridge
- Former VP Discovery, Regeneron
- 20 years protein therapeutics experience
- Discovered 2 blockbuster antibody drugs ($5B+ revenue)

James Morrison — COO

- MBA Harvard Business School
- Former McKinsey Partner, healthcare practice
- Built operations at Moderna during scale-up
- Deep biotech investor network

Advisory Board

- David Baker (Institute for Protein Design)
- Daphne Koller (Insitro CEO)
- John Maraganore (former Alnylam CEO)
- George Church (Harvard, synthetic biology pioneer)

Financials

Use of Funds ($20M Seed)

Category	Allocation	Purpose
R&D / Engineering	$10M	Model development, platform build
Compute Infrastructure	$4M	GPU clusters for training/inference
Wet Lab Validation	$3M	Experimental validation partnerships
Go-to-Market	$2M	Sales, marketing, partnerships
Operations	$1M	Legal, admin, facilities

Projected Financials

Year	Revenue	Gross Profit	Net Income	Headcount
2026	$2M	$1.6M	-$12M	35
2027	$12M	$10M	-$8M	65
2028	$45M	$38M	$5M	120
2029	$120M	$102M	$35M	200

Year	Revenue	Gross Profit	Net Income	Headcount
2030	$300M	$255M	$100M	350

Key Assumptions

- 40% YoY customer growth after 2027
- 85% gross margin maintained
- R&D at 35% of revenue long-term
- Profitability in Year 3

Risk Factors & Mitigations

Risk	Probability	Impact	Mitigation
Technical: Models don't generalize	Medium	High	Diverse training data, experimental feedback
Competition from Big Tech	Medium	Medium	Speed to market, domain expertise, data moat
Regulatory uncertainty	Low	Medium	Engage FDA early, conservative claims
Talent acquisition	Medium	Medium	Equity packages, mission-driven culture
Long sales cycles	High	Medium	Land-and-expand, POC programs

The Investment Thesis

Why SynthLife Wins

1. **Perfect Timing:** AlphaFold proved AI can understand proteins. Now it's time to design them.
2. **Massive Market:** $280B TAM across therapeutics, materials, agriculture, industrial — we're the picks and shovels.
3. **Technical Moat:** Proprietary models + experimental feedback loop = compounding advantage.
4. **World-Class Team:** AlphaFold DNA, Genentech experience, proven operators.
5. **Clear Path to $1B+:** Platform economics with expansion into multiple verticals.

Comparable Exits

Company	Sector	Exit Value	Revenue at Exit
Grail	Cancer screening	$8B	$100M
Recursion	Drug discovery	$6B (market cap)	$200M
Zymergen	Biomanufacturing	$3B (peak)	$50M
Generate Biomedicines	Protein design	$1.5B (valuation)	Pre-revenue

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The Ask

$20M Seed Round

- Lead: $12M
- Strategic co-investors: $8M (pharma CVCs preferred)
- Valuation: $100M pre-money

What we deliver: - SynthLife platform v1.0 (12 months) - 10 paying biotech customers - 3 therapeutic programs in pipeline - Series A ready with $5M ARR trajectory

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Contact

SynthLife, Inc.

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"The 20th century was defined by chemistry. The 21st century will be defined by biology. SynthLife is the platform that makes that future possible."

— Dr. Sarah Chen, CEO