Accelerating synthetic biology research with AI: Phage therapy for multidrug resistant bacteria

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bioAI team

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B.Sc in Biochemistry, worked in this field

Ph.D. in Computer Science

ML + UX co-op @ Google Research

Global TA for MIT How To Grow Almost Anything (htgaa.org)

Use AI to treat multidrug resistant bacteria

Accelerate biomedical research with AI and synbio

Synthetic biology applies engineering principles to biology

Use phage therapy as a platform - Final project in HTGAA

Entrez to access PubMed

GPT4 to rate abstract for relevance

New kind of bioinformatics?

Synbio (Synthetic biology)

- Synthetic Biology
  - Innovative Approach: Combines engineering principles with biology.
  - Personalized Therapies: Tailors treatments to individual genetic profiles.
- AI and Biology Intersection:
  - Enhanced Drug Development: AI accelerates research and discovery.
  - Predictive Modeling: AI predicts treatment efficacy and patient responses.

Entrez Pubmed

Central biomedical literature database.

Millions of diverse scientific articles.

- AI Relevance:
  - Rich text data source for machine learning.
  - Broad topic range for diverse training.
- AI Applications:
  - Enhances NLP and predictive modeling.
  - Supports synthetic data generation in AI.

Market analysis

- Global Market Size (2023): USD 15 billion
- Projected Growth (2031): USD 34 billion
- CAGR (2023-2031): 13.7%
- Key Growth Drivers:
  - Demand for integrated data, proteomics, and genomics advancements
  - Need for integrated solutions and systems
- Leading Regions:
  - North America (largest market, CAGR 12.4%)
  - Asia-Pacific (fastest-growing, CAGR 18.4%)
- Key Segments:
  - Bioinformatics services (largest share, CAGR 23.1%)
  - Genomics (CAGR 11.3%)
  - Medical bioinformatics (CAGR 8.7%)

Technology

1) Biopython entrez pubmed

2) OpenAI - GPT4

3) Get phage from user

4) Get hypothesis from user

5) Get all relevant abstracts from pubmed

6) Run GPT4 on each abstract

Demo

Potential Revenue Streams in AI for synthetic biology

Drug discovery and development

Genetic engineering services

Custom microorganisms for industry

Bioinformatics services

Synthetic biology tools and APIs

Key Competitors in AI for synthetic biology

BenchSci : Specializes in AI-driven literature analysis for antibody discovery and research.

Ginkgo Bioworks: Specializes in programming cells for a wide range of applications, leveraging automation and machine learning.

Twist Bioscience: Offers high-throughput DNA synthesis technologies for applications in medicine, agriculture, and industrial chemicals.

Amyris: Uses synthetic biology and an AI-driven platform for sustainable production of chemicals and materials..

DeepMind Technologies (Google Health) : Involved in various healthcare AI projects, including cancer-related research.

Generative LLM model for synthetic biology research

Protein Design: Predict and design novel proteins with specific functions.

Genetic Circuit Optimization: Suggest improvements for synthetic biological systems.

DNA Sequence Automation: Generate optimal DNA sequences for targeted applications.

Biological System Predictions: Forecast outcomes of biological interactions.\

Bioinformatics Insights: Derive insights from complex bioinformatics datasets.