

Accelerating cancer research with RAG

Steven Ness
[doi.bio](https://doi.org/10.26434/chemrxiv-2024-11)

doi.bio team

[Steven Ness](#)

CEO at doi.bio

"Understand biology"

Ph.D. in Computer Science

ML + UX co-op @ Google Research

Previous work in bioinformatics

Use AI to cure cancer with Synbio (synthetic biology)

Accelerate cancer research with RAG

System designed for bioinformaticians

Written in Python with zsh

Uses Entrez to access PubMed

New kind of bioinformatics?

Synbio (Synthetic biology)

- Synthetic Biology in Cancer Treatment:
 - Innovative Approach: Combines engineering principles with biology.
 - Personalized Therapies: Tailors treatments to individual genetic profiles.
- Tebentafusp Example:
 - Breakthrough Treatment: First-in-class for uveal melanoma.
 - Mechanism: Targets cancer cells with synthetic protein.
- 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) co.chat with Web search for latest FDA approvals for cancer treatment

e.g. Tebentafusp

2) For each entry:

a) Use edirect cli tool to download abstracts

b) co.chat() documents : Evaluate efficacy and side effects

c) co.chat() web search : Business summary of company

Demo

1) co.chat() websearch

message: What are some of the most recently approved FDA T-cell immunotherapy treatments for eye cancer?

text: Uveal melanoma is an aggressive cancer of the eye with historically poor outcomes, as it would usually result in death within a year of metastasis. Recently, the FDA approved Kimmtrak (tebentafusp), a novel type of immunotherapy for the treatment of advanced uveal melanoma. Kimmtrak is a bispecific T-cell engager, linking cancer-fighting T cells to their targets on tumors. It is administered by IV infusion once weekly and it has improved overall survival in clinical trials. According to Kyleigh LiPira, CEO of the Melanoma Research Foundation, Kimmtrak represents "not only a new therapy but a new hope for the individuals and the families of those diagnosed with the deadliest form of eye cancer."

Demo

2.a) Entrez search using Edirect

```
for PMID in $(esearch -db pubmed -query "tebentafusp" | efetch  
-format uid); do efetch -db pubmed -id $PMID -format abstract >  
"$PMID.txt"; done
```

This returns 67 abstracts

Demo

2.b) Evaluate efficacy and side effects

Python script to read all documents from Entrez

Upload documents to Cohere via `co.chat()`

Demo

message: Please evaluate tebentafusp for efficacy

text: I found various studies that evaluate the efficacy of Tebentafusp. One study that examined the safety and initial efficacy of tebentafusp in combination with durvalumab and/or tremelimumab in patients with metastatic cutaneous melanoma (mCM), reports a 14% response rate and a 41% tumor shrinkage rate. whereas the 1-year overall survival (OS) rate was 76%. Another analysis found that the 1-year OS for the triplet combination was 79%, which was similar to tebentafusp plus durvalumab (74%). Another study focusing on metastatic uveal melanoma, reports that tebentafusp has demonstrated an overall survival benefit (HR 0.51) and an overall response rate of 9%. In another study, tebentafusp showed a conspicuously longer overall survival than the control group, yielding an additional 0.47 Quality-Adjusted Life Years (QALYs) compared to the control group.

Overall, the results suggest that tebentafusp could change the standard of care for treating metastatic and potentially localized uveal melanoma.

Demo

2.c) Business summary

Write business summary of company

Use `co.chat()` with `websearch`

Demo

Business Analysis of Immunocore with relation to Tebentafusp

Immunocore is a biotechnology company that researches and develops novel T-cell receptor-based drugs to treat diseases with a high unmet need, including cancer and viral diseases.

Tebentafusp is a bispecific T-cell engager (BiTE) therapy that was the first drug to be approved by the FDA to treat metastatic uveal melanoma (mUM).

Given Immunocore's focus on developing novel T-cell receptor-based therapies to treat diseases with a high unmet need, their current market and future potential in the biotechnology sector looks promising.