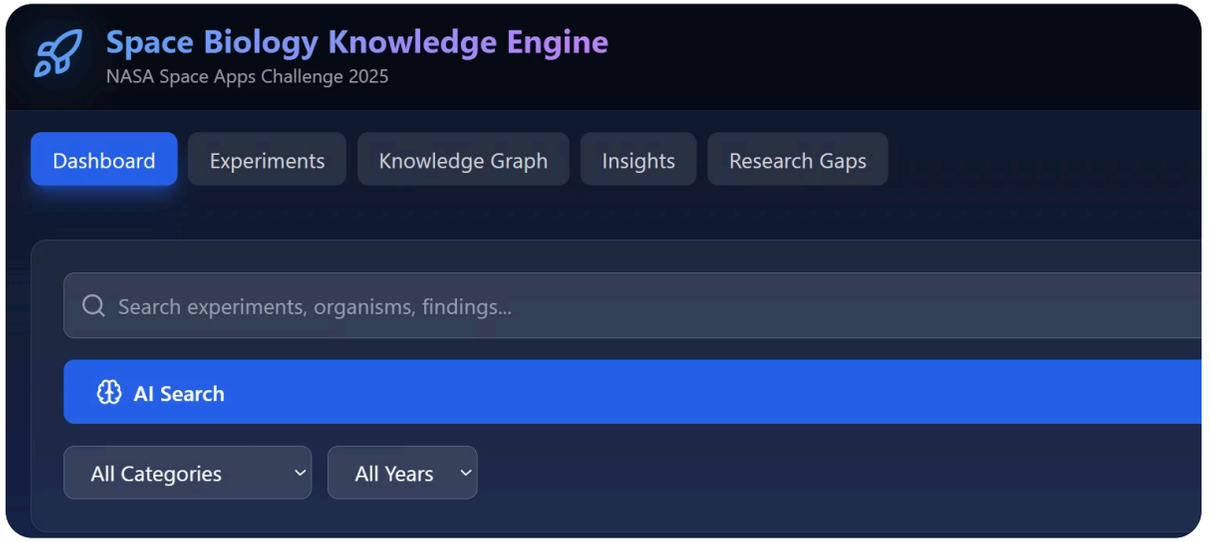
Space Biology Knowledge Engine - **Spacemates**

A web app that leverages AI and a knowledge graph to summarize and explore NASA's 608 bioscience publications. This tool unifies scattered research on space biology experiments, making it easier to discover connections, impacts, and results across missions.



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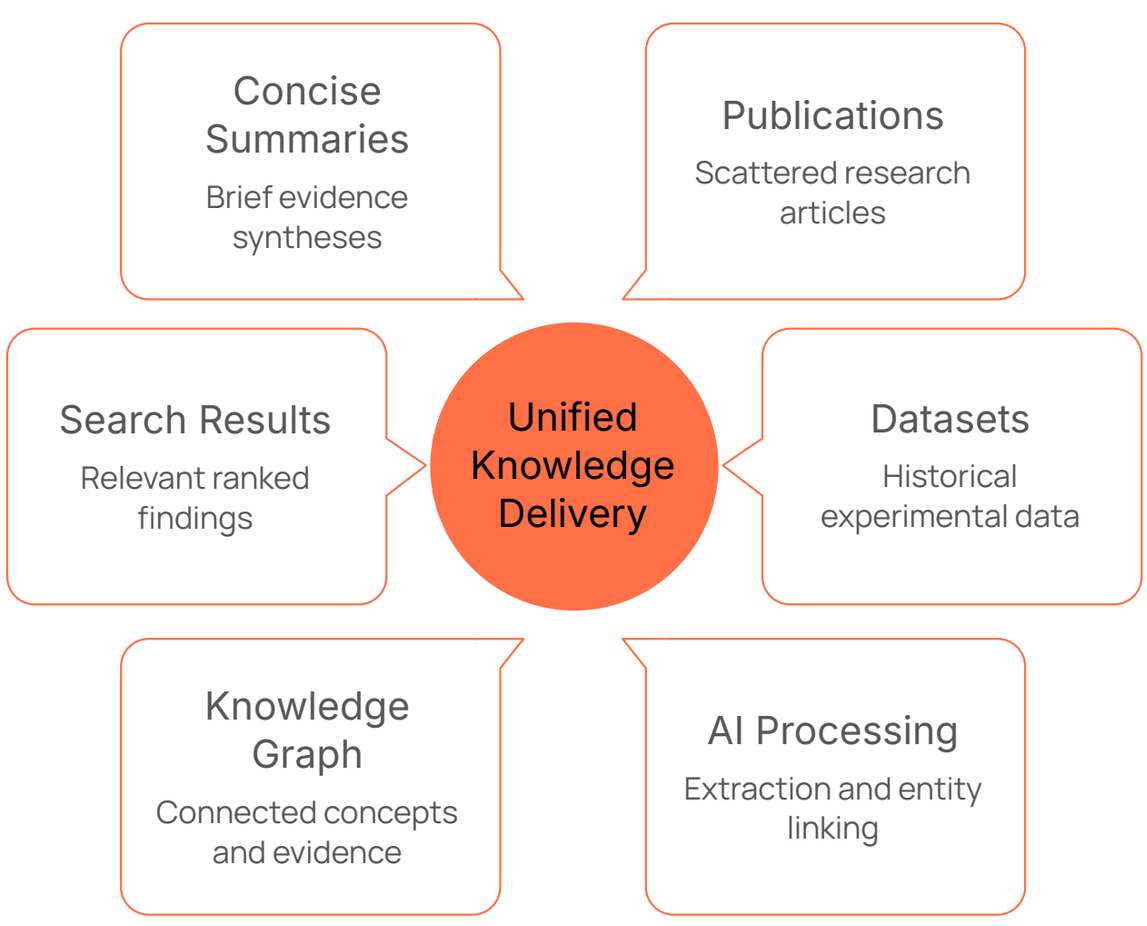
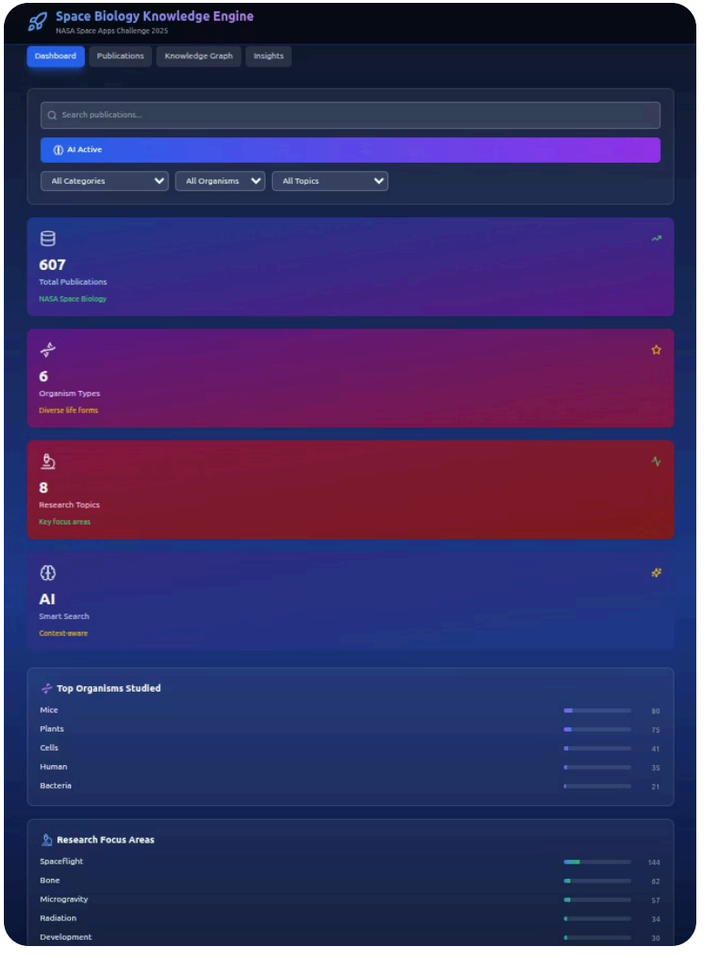
Repository:-
https://github.com/ChowdharyYash/NASA_Space_Apps.git

The Challenge in Space Biology Research

NASA's decades of space biology research span hundreds of publications and datasets, often scattered across repositories. This fragmentation makes it difficult for users to quickly identify connections, key findings, and patterns in experiments involving organisms, missions, and environmental exposures.

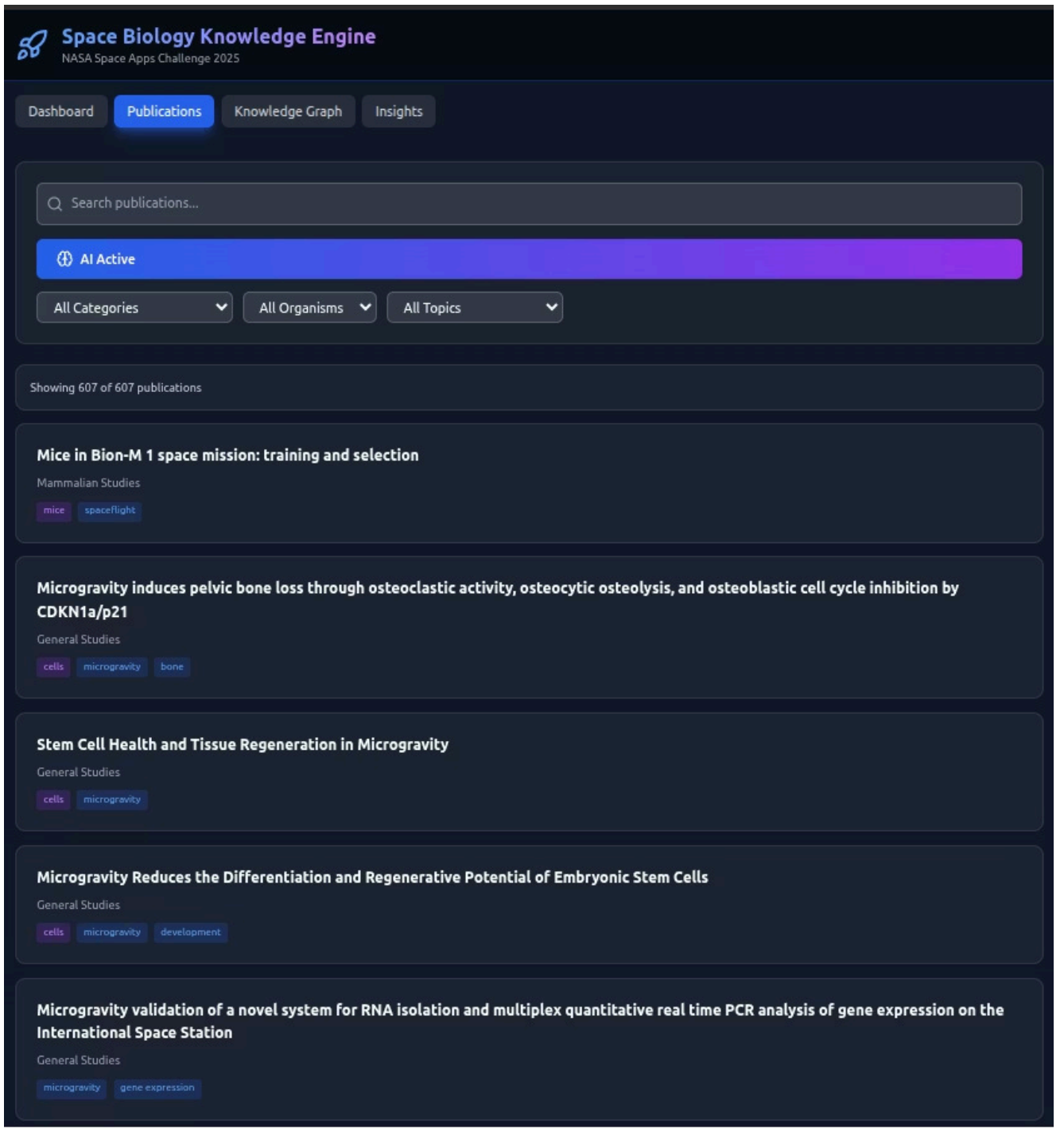




Our objective: As seen above - develop a user-friendly knowledge engine that ingests these sources, applies AI for summarization, and builds a graph to reveal relationships across missions, organisms, exposures, methods, and outcomes.

Target Users and Their Needs

The app serves diverse users: research scientists seeking deep insights, mission planners integrating biology data, educators teaching space adaptation, and students exploring real experiments.



As a Scientist

I want to find rodent and plant studies on microgravity-induced bone or gene-expression changes, grouped by mission and method, to accelerate my research.

As an Educator

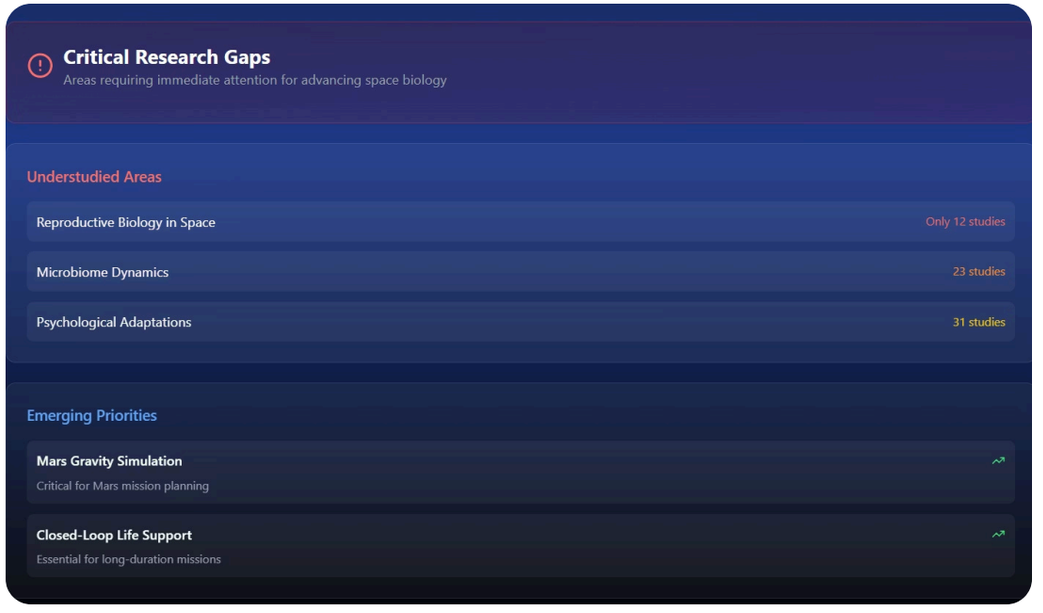
I want to show students concise summaries and images of how organisms adapt in space, with clear examples from actual missions, to make lessons engaging and informative.

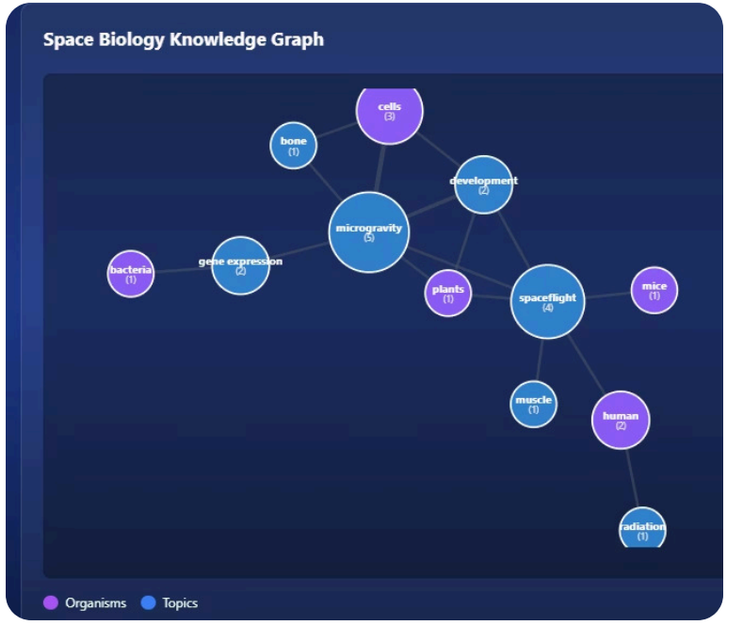
Success criteria include faster time-to-answer queries, clean cross-links between papers, and trustworthy AI-generated summaries always linked to original sources

Data Foundation and Scope

Core dataset: The official NASA repository of approximately 608 bioscience publications (link: [NASA Life Sciences Data Archive]). We begin with titles and abstracts for quick ingestion, expanding to full texts later.

Entity Type	Organism	Mission	Exposure	Method	Outcome
Description	(e.g., Mouse, Arabidopsis)	(e.g., ISS, SpaceX)	(Microgravity, Radiation)	(RNA-seq, Microarray)	(Bone loss, Immune response)





We show various **Critical Research Gaps, Understudied Areas and Priorities** from the source metadata, mission logs, and experiment records to enrich the **knowledge graph** shown above with detailed biological signals

System Architecture

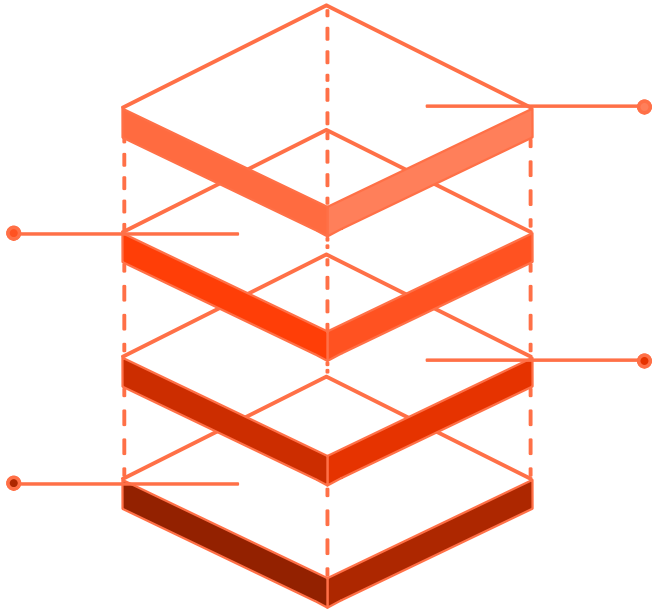
Our prototype uses a modular 3-layer architecture that connects AI analysis with an interactive knowledge dashboard. Built in React, it processes NASA bioscience publications into structured, explorable intelligence.

Graph Store

Stores interconnected entities as a knowledge graph (Neo4j or relational DB), enabling dynamic queries and visual exploration.

Ingest

Publication CSV/API → Parse titles & abstracts



API & UI

Users can perform AI-assisted searches, filter by year or category, and instantly see relevance-ranked summaries and relationships.

AI Layer

Applies natural language embeddings for summarization, entity tagging (organisms, missions, outcomes), and semantic similarity scoring.

The flow ensures efficient data handling: Raw publications feed into AI for extraction, populate the knowledge graph for relationships, and deliver via a clean API to an intuitive web frontend.

AI-Powered Insights Engine

Discover patterns and generating knowledge from decades of space biology data

Our AI-powered insights engine processes NASA's bioscience publications to identify patterns, correlations, and knowledge gaps across decades of space biology research. The system uses semantic search, entity recognition, and knowledge graph analysis to surface meaningful connections that would be difficult to discover manually.

The following examples demonstrate the types of insights that can be drawn from our analysis:

Top Research Findings

Spaceflight is the most studied topic,

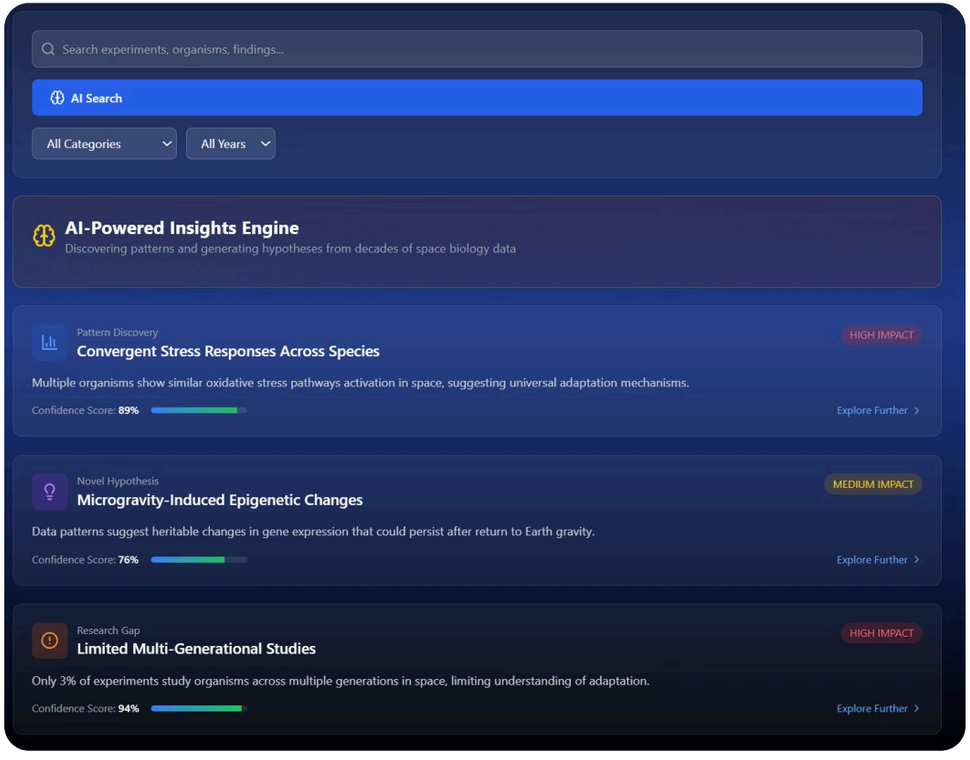
HIGH IMPACT | Confidence Score: 94%

Appearing in 144 publications.

Microgravity-Induced Epigenetic Changes

MEDIUM IMPACT | Confidence Score: 78%

Data reveals unexpected heritable changes in gene expression that persist after return to Earth gravity.



Thank You for Exploring Spacemates!

We appreciate you taking the time to learn about the Space Biology Knowledge Engine. Our team, Spacemates, is designed to transform how NASA's vast collection of bioscience publications is accessed and understood.

By leveraging AI and a knowledge graph, we unify scattered research, making it easier for scientists, educators, and students to discover critical connections, impacts, and results across missions and experiments. Our goal is to accelerate discovery and innovation in space biology.