

# AI-assisted Design of virus-binding proteins for the International Genetically Engineered Machine competition

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## Abstract

Contains in clear language the problem statement, the indication of methodology, the main findings and the principal conclusion.

## General Context

Describe what your laboratory, company, institution is doing in general. Describe precisely what your team does and what their expertise is in a few lines. (don't copy -paste a boiler). Who are the key people you worked with and how did they acquire their expertise (mention their degrees, professional experience... ). Mention any other people you or your team collaborated with during your internship (limited to the particular topic you worked on). Add 3-4 lines on your integration to the institution and the work environment. Connection to the sustainable development goals (list the SDGs), if any.

This report details my involvement in the Paris-Bettencourt team's collaborative participation in the International Genetically Engineered Machine (iGEM) contest [1]. The iGEM competition, held annually, is a globally recognized Synthetic Biology competition, uniting participants across three distinct age groups: high school, undergraduate, and graduate students [2].

The topics covered by the competition are divided into 15 themes called villages [3]. Paris-Bettencourt project, named "Lubritect", was part of the Therapeutics village.

Lubritect is an innovative solution that combines mucin-based hydrogel with AI-generated protein structures, aiming to reduce the transmission of sexually transmitted infections (STIs). This approach leverages de novo protein design for versatility against various pathogens. Lubritect was designed as an answer for alarming statistics regarding STIs, with high incidence (1

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million new sexually transmitted infections every day), prevalence (80% of sexually active individuals will acquire human papillomavirus by 45) and disease burden (82,000 deaths in 2019 from hepatitis B) [4].

Paris-Bettencourt team is hosted by Learning Planet Institute, consisting from 7 Learning Planet students, and 3 Non-Learning Planet students. Each having a specific role like wetlab, drylab, or human practices ...etc. My main role in this project was generating and *in-silico* testing of new protein structures to bind to the targets of interest. The team is supervised by 4 supervisors: Ariel Lindner, Ernest Mordret, Helena Shomar, and Amir Pandi [5]. **Should I talk more about the supervisors ?**

## 1 Introduction

Past research or work in the field. Define precisely what are the questions, objectives and tasks you were given. Connect them with a scientific or technical context. What are the approaches generally used to solve the problem ? (Reference them) What are the underlying assumptions or hypotheses, if any? Question raising. What are their limitations ? Is there a gap ? Which one ? Purpose of the present research or work and experimental strategy chosen to address your scientific question Literature review. It is an echo to the points raised in the introduction. You can reference findings and describe the state-of-the art.

## 2 Methods

(1-2 pages with figures if relevant): (Methods is a section valid for any internship, not only research oriented, experimental or theoretical. You did something according to a method, which is what you should understand and present here.) Present in detail the tools, techniques and methods you have used and why (giving a list of library's or equipment's name is not a presentation). Describe the scientific and/ or technical background with clear explanations, references, equations and/ or schematics or pictures.

## 3 Results

(2-3 pages with figures): Precisely describe the results of your work with clear explanations of the analysis, schematics and figures. Describe what worked, what didn't and why.

## 4 Discussion

(1 page): Review findings. Discuss outcomes. Do your results make sense ? Evaluate them Do they provide elements towards solving your problem ? Which ones ? Do they open up new questions (scientific or technical).

## 5 Conclusion

( $\frac{1}{2}$  to 1 page maximum): Conclude regarding the missions and tasks you were given and the results you obtained . Mention if they will be used by your team. What are the limitations of your results ? What are the future directions (questions, implementation...) ?

others

**Check the Internship validation: Guidelines 2023-2024**

## References

1. IGEM Foundation. *iGEM foundation Main page* <https://igem.org/> (2024).
2. IGEM Foundation. *iGEM competition About page* <https://competition.igem.org/participation/introduction> (2024).
3. IGEM Foundation. *iGEM competition Villages page* <https://competition.igem.org/participation/villages> (2024).
4. IGEM Team, P. B. *Paris Bettencourt Project page* <https://2023.igem.wiki/paris-bettencourt/description> (2024).
5. IGEM Team, P. B. *Paris Bettencourt Team page* <https://2023.igem.wiki/paris-bettencourt/team> (2024).