



Single Agent Most Effective in Treating Follicular Lymphoma

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ABSTRACT

Purpose

Discover which single agent is best for treating follicular Non-Hodgkin's Lymphoma, a disease affecting tens of thousands of people each year.

Research Question

Out of bendamustine, cyclophosphamide, and fludarabine, which single agent is the most effective in treating follicular lymphoma?

Design of Study

Online research
Lab consisting of running named single agents on two types of mouse lymphoma cells

Major Findings

For both types of cells, fludarabine had the lowest IC50, the concentration of drug which inhibits 50% of the target.

Interpretation

Lower IC50 means higher potency of drug, which means fludarabine is the strongest of the three and should kill the largest number of lymphoma cells at the given IC50 concentration.

BACKGROUND

Lymphoma is defined as any cancer affecting the lymphocytes and immune system. It is divided into two main subcategories, **Non-Hodgkin's (NHL)** and **Hodgkin's lymphomas (HL)**, with the main difference being that HL involves a type of large, abnormal B lymphocytes called Reed-Sternberg cells, while NHL does not (American Cancer Society, 2016). Follicular lymphoma (FL) is the most common form of indolent, or slow-growing, NHLs.

**20% - 30% OF ALL LYMPHOMAS
ARE COMPRISED OF FOLLICULAR LYMPHOMA**

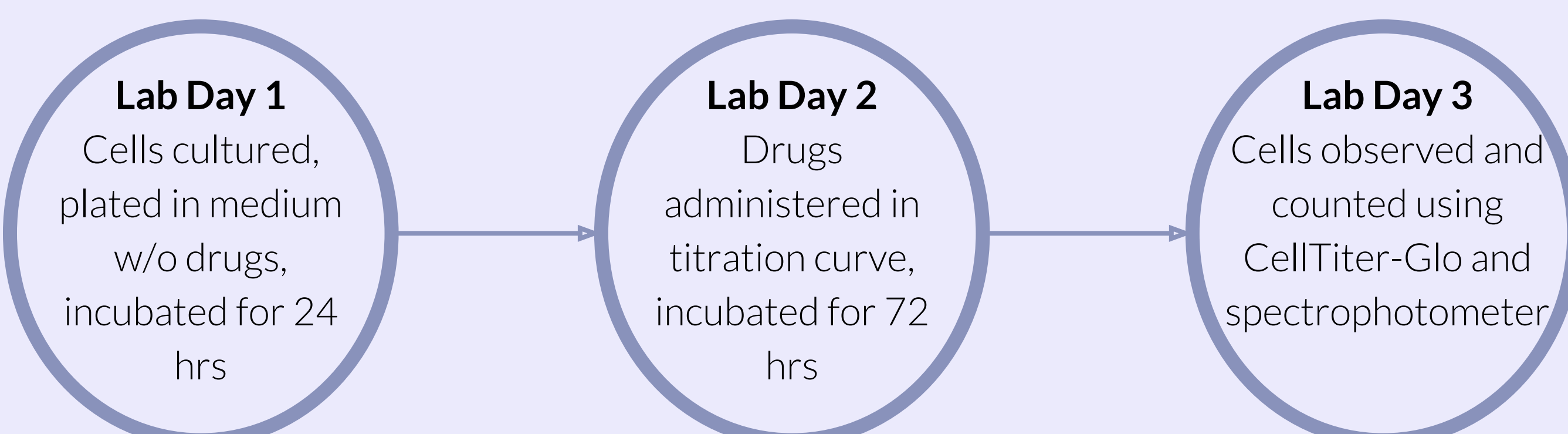
**14,448 - 21,672 PEOPLE
ARE AFFECTED BY FL EVERY YEAR IN THE USA**

**5,000 PEOPLE
LOSE THEIR LIVES TO FL EVERY YEAR IN THE USA**
(American Cancer Society, 2017)

For just FL, there are **8 first-line treatments**, but there are also **74 approved drugs** and **10 treatment regimens** for NHL in general, often making it difficult for patients to choose the most suitable drug (National Cancer Institute, 2015).

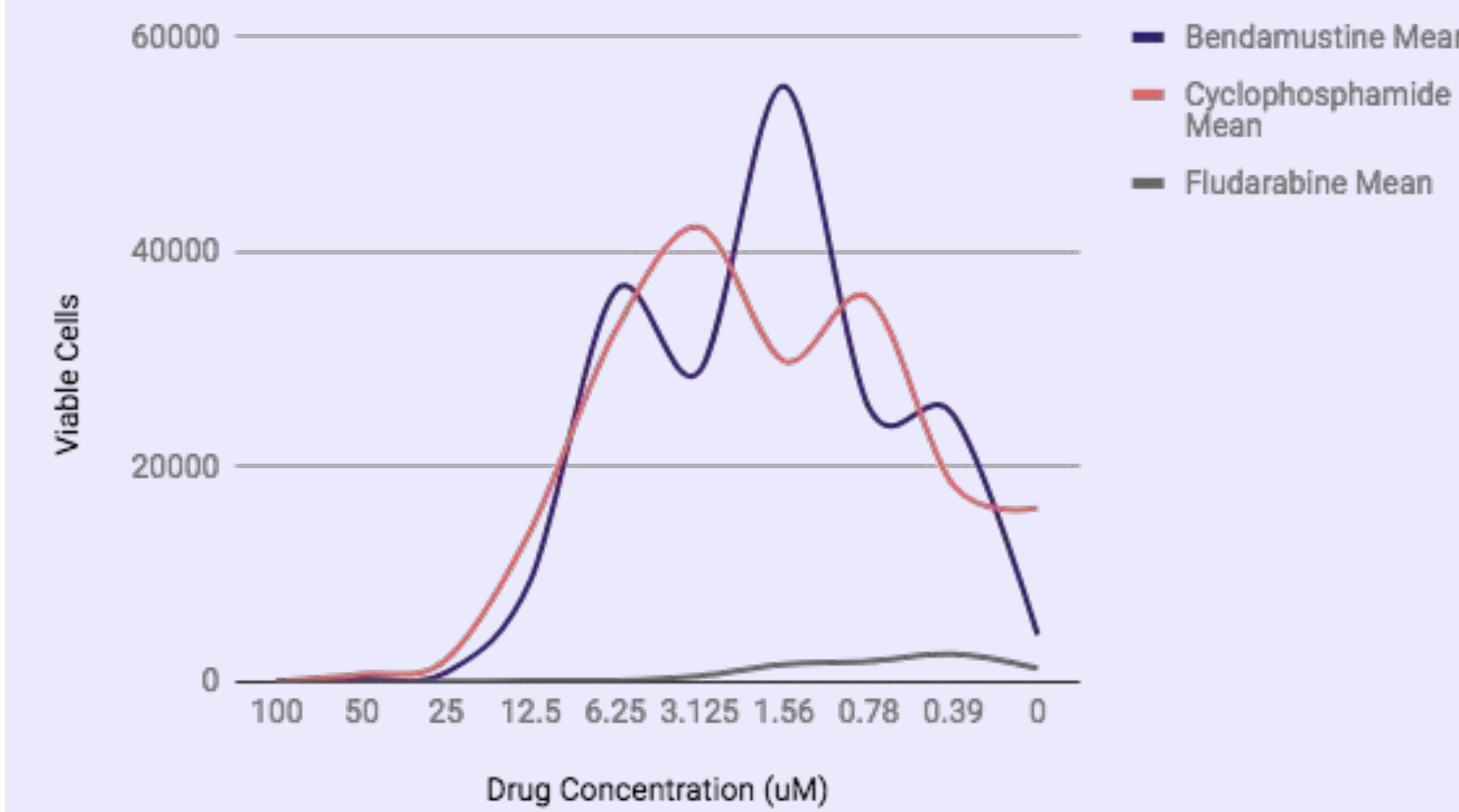
RESEARCH METHODOLOGIES

The inquiry approaches used in this research project were the **true experimental research** and **evaluation research**. The true experimental research was used to test the effectiveness of individual single agents in the lab and the evaluation research was used to compare and contrast the results from clinical trials completed by other researchers and scientists. The majority of the data collected was **quantitative** because one of the inquiry approaches used is true experimental, which is primarily quantitative.



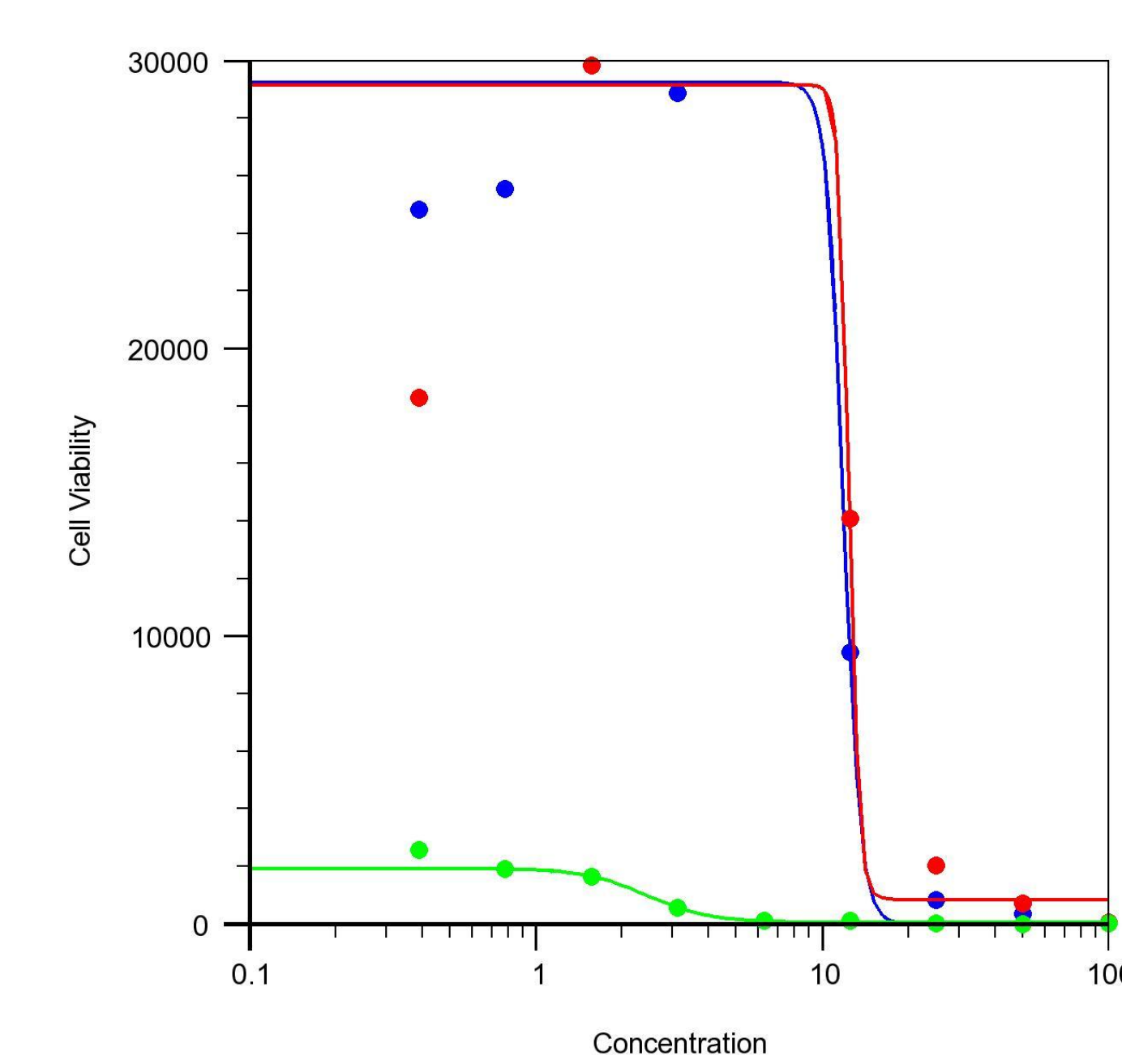
DATA AND FINDINGS

HH2 Lymphoma Cell Viability with Given Drugs



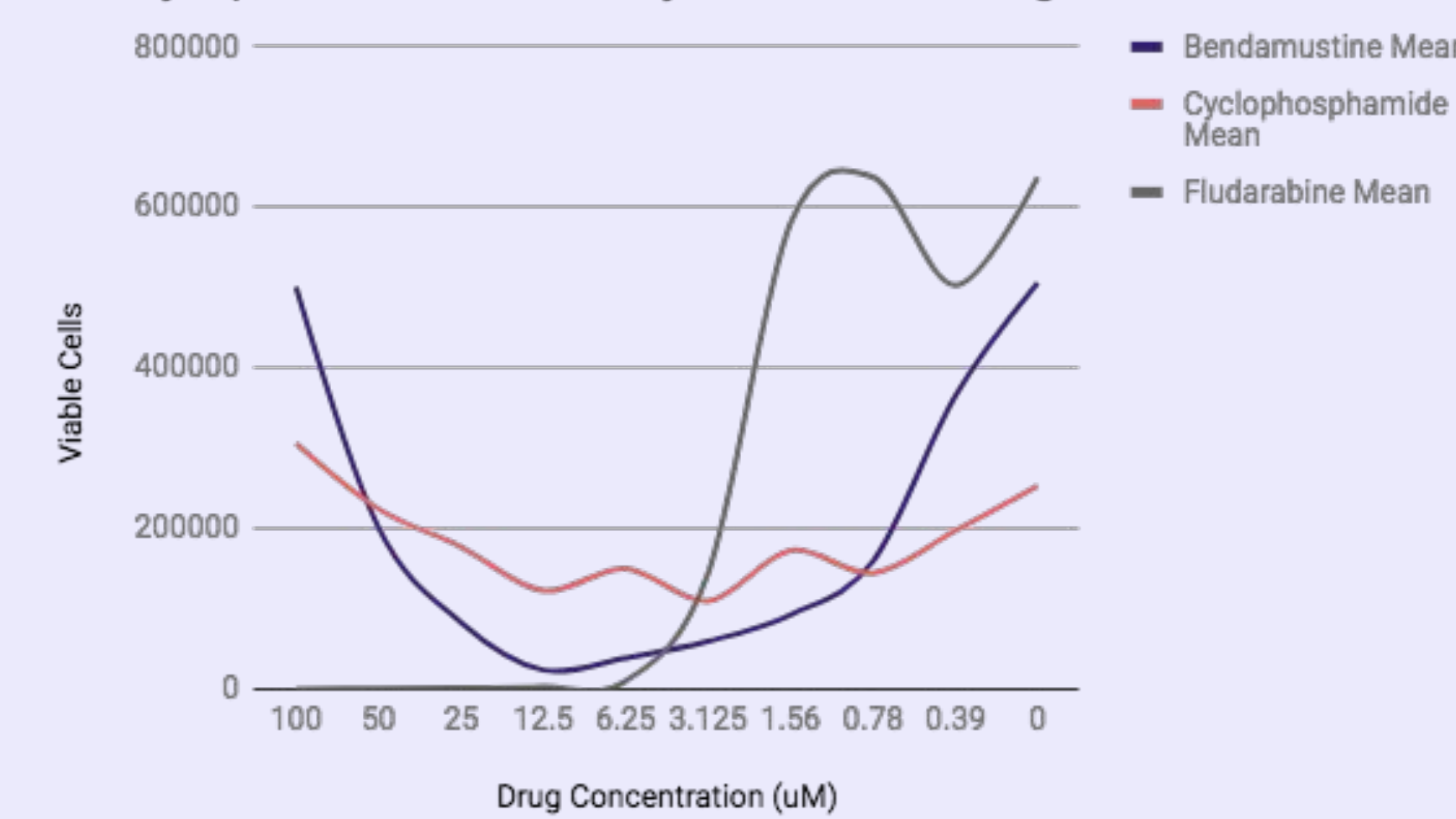
(Figure 1) - Graph shows HH2 cell viability with use of microliters of drugs.

IC50 of HH2 Cells



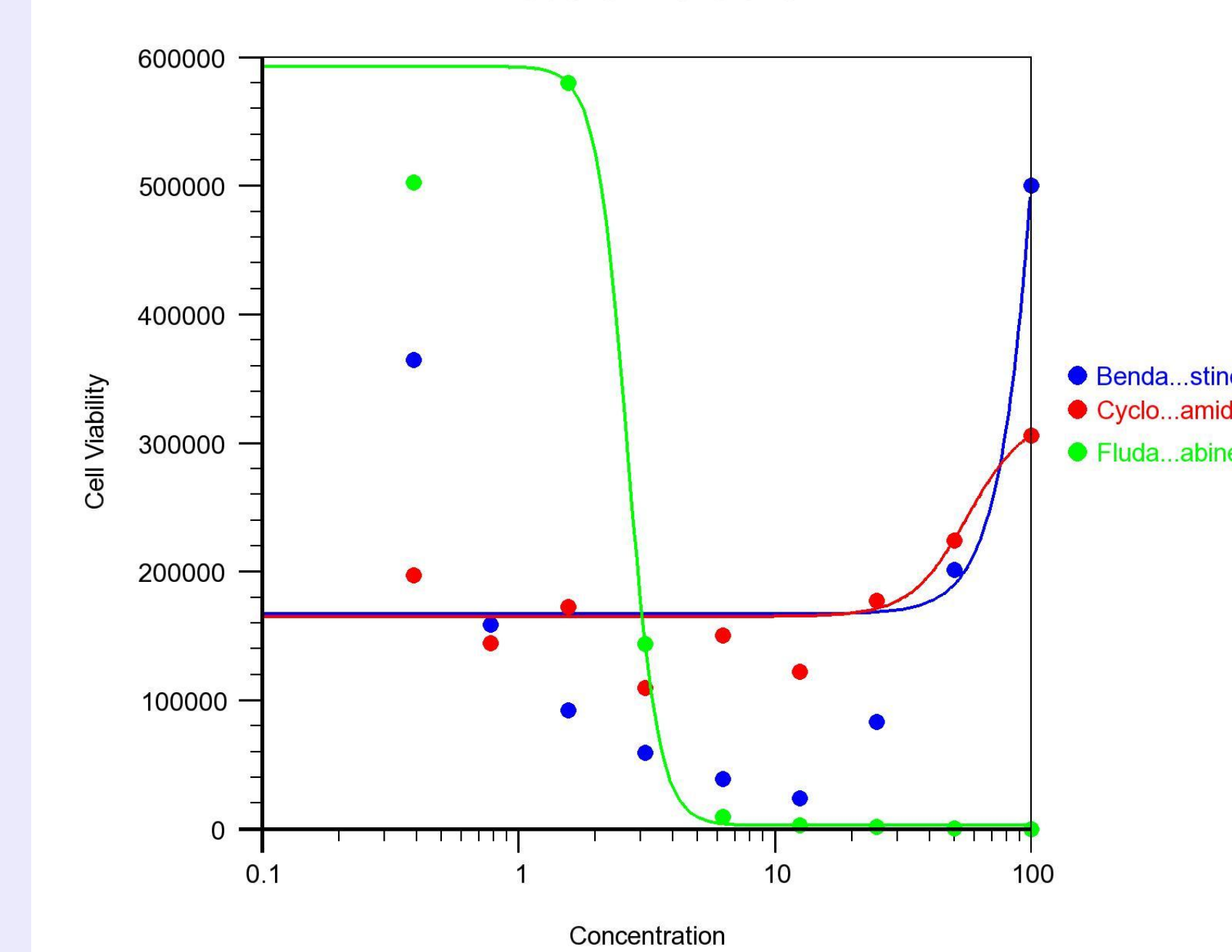
(Figure 2) - Graph shows sigmoidal relationship between HH2 cell viability with use of microliters of drugs. Shows concentration of drugs when response is reduced by half.

H9 Lymphoma Cell Viability with Given Drugs



(Figure 3) - Graph shows H9 cell viability with use of microliters of drugs.

IC50 of H9 Cells



(Figure 4) - Graph shows sigmoidal relationship between H9 cell viability with use of microliters of drugs. Shows concentration of drugs when response is reduced by half.

DISCUSSION, ANALYSIS, AND EVALUATION

Cells Used

HH2 and H9 are both derived from T-cell mouse lymphoma cell lines. Although follicular lymphoma affects B-cell lymphocytes, the drugs chosen have similar effects on both T-cells and B-cells.

Drugs Used

All drugs used in this lab are unique single agents in three different first-line treatment regimens — Bendamustine from treatment regimen R-bendamustine, cyclophosphamide from R-CVP, and fludarabine from R-fludarabine.

IC50 of bendamustine	IC50 of cyclophosphamide	IC50 of fludarabine
11.9 uM in HH2 cells 188.9 uM in H9 cells	12.4 uM in HH2 cells 56.6 uM in H9 cells	2.43 uM in HH2 cells 2.66 uM in H9 cells

Possible Errors

Although the drugs were meant to be run in triplicates on both types of cells, due to miscalculations of required materials, HH2 cell trials could only be run in duplicates. The numbers of surviving cells for bendamustine administered to H9 cells and fludarabine to HH2 cells are also off, most likely due to cell plating errors, but assuming the trend between the IC50s of the drugs remains consistent, the IC50 of bendamustine administered to H9 cells should still be greater than that of fludarabine.

CONCLUSIONS AND NEXT STEPS

Results

Because cyclophosphamide is the most commonly used in a variety treatment regimens out of the three, the hypothesis stated that cyclophosphamide would kill the largest amount of lymphoma cells.

Compared to cyclophosphamide and bendamustine, however, **fludarabine** had the largest effect on lymphoma cells. Because the **IC50 of fludarabine is the lowest overall**, the drug itself is the most potent, and would be the most effective in treating follicular lymphoma, out of the three, as long as the patient has no other chronic illness or factors affecting the treatment. The lower an IC50 of a drug is, the stronger the drug because this means less drug is required to kill the same amount of cells. Although Fludarabine was the most effective in killing cells, it is also likely that it is more toxic, which is why it is used less frequently.

Next Steps

Potential experiment extensions include testing the effects of treatment regimens, instead of single agents, on the cells lines. Other possibilities include using human cell lines, other animal T-cell lines or using mouse B-cell lymphoma cell lines.

ACKNOWLEDGEMENTS / REFERENCES

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