**Research Methods**

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1. **Title**  
   Developing an R-Based Tool for Visualizing Gut Microbiome Localization
2. **Research questions**  
   Where do different bacterial species localize in the gut, and can this localization be linked to development of certain microbe associated diseases? How can we develop a tool for visualizing microbiome distribution in the proximal and distal colon using R?
3. **Objectives**

* Develop an R-based tool or platform to visualize microbiome spatial distribution.
* Implement data processing and visualization methods using R for microbiome datasets.
* Provide functional code and documentation for microbiome researchers and those in the medical community.

1. **Approach**  
   R provides powerful tools for microbiome data analysis and visualization. This project will use the **phyloseq** package for microbiome data processing, **ggplot2** for visualization, and **Shiny** for interactive exploration. The tool will process microbiome sequencing data, enabling researchers and doctors to explore bacterial localization across gut regions. Functional code and documentation will be made available for further adaptation by microbiome researchers.
2. **Selected References**

* McMurdie, P. J., & Holmes, S. (2013). phyloseq: An R package for reproducible interactive analysis and graphics of microbiome census data. *PLoS One*, 8(4), e61217.
* Callahan, B. J., et al. (2016). DADA2: High-resolution sample inference from Illumina amplicon data. *Nature Methods*, 13(7), 581–583.
* Martino, C., et al. (2021). A novel interactive microbiome visualization tool for spatially resolved data. *Nature Methods*, 18(5), 511–519.
* Knight, R., et al. (2018). Best practices for analyzing microbiomes. *Nature Reviews Microbiology*, 16(7), 410–422.
* Tropini, C., Earle, K. A., Huang, K. C., & Sonnenburg, J. L. (2017). The gut microbiome: Connecting spatial organization to function. *Cell Host & Microbe*, 21(4), 433-442.
* Gu, S., Chen, Y., Zhang, X., Lu, H., & Lv, T. (2013). Bacterial community mapping of the intestinal tract in colorectal cancer patients. *Microbial Ecology*, 66(2), 460-470.