

	Question	Value
1,1	Proposal	
1,2	Name	Computational Modeling of Sweet Consumption Frequency's Effect on the Oral Microbiome
1,3	Description	<p>This project aims to develop a computational model to explore how the frequency of sugar consumption impacts the oral microbiome and its effects on dental health in infants. While the relationship between sugar intake and dental caries is well documented, the influence of the frequency of sugar consumption on the oral microbiome is less understood. When sugar is consumed, it is metabolized by bacteria in the mouth, leading to acid production, pH changes, and potential damage to tooth enamel. By utilizing agent-based modeling and reaction-diffusion models [1], we can simulate and predict ecological shifts within the oral microbiome, allowing us to better understand the effects of varying sugar consumption frequencies on microbial populations and caries risk.</p> <p>Our study will draw inspiration from existing research, which has shown that higher frequencies of sugar consumption can reduce microbial diversity and shift the composition towards acid-producing bacteria [2]. The relationship between sugar intake and caries is complex, as certain microbial communities may predispose individuals to caries even with low sugar intake, or conversely, offer protection against caries in high-sugar environments [3]. Longitudinal studies have also demonstrated that frequent sugar exposure can lead to changes in microbial composition, including increases in certain bacteria associated with caries [4]. Our computational model will serve as a tool to understand how sugar consumption frequency shapes the oral microbiome. The insights gained from this study will contribute to more precise, evidence-based recommendations for maintaining oral health, particularly in infants.</p> <ol style="list-style-type: none"> 1. Hester SD, Belmonte JM, Gens JS, Clendenon SG, Glazier JA (2011) A Multi-cell, Multi-scale Model of Vertebrate Segmentation and Somite Formation. PLOS Computational Biology 7(10): e1002155. https://doi.org/10.1371/journal.pcbi.1002155 2. Chen, X., Hu, X., Fang, J., Sun, X., Zhu, F., Sun, Y., & Wang, Y. (2022). Association of oral microbiota profile with sugar-sweetened beverages consumption in school-aged children. International Journal of Food Sciences and Nutrition, 73(1), 82-92. DOI: 10.1080/09637486.2021.1913102 3. Pang, L., Zhi, Q., Jian, W., Liu, Z., & Lin, H. (2022). The Oral Microbiome Impacts the Link between Sugar Consumption and Caries: A Preliminary Study. Nutrients, 14(18), 3693. DOI: 10.3390/nu14183693 4. Olsen, C. L., Markvart, M., Vendius, V. F. D., Damgaard, C., & Belstrøm, D. (2023). Short-term sugar stress induces compositional changes and loss of diversity of the supragingival microbiota. Journal of Oral Microbiology, 15(1), 2189770. DOI: 10.1080/20002297.2023.2189770
1,4	Work environment	The students will join a diverse team of researchers from the Informatics Institute (IVI) and ACTA. This group includes experts in modeling, experimental design, and validation. Students will have the opportunity to work closely with the researchers and contribute to the development of the computational model aimed at unravelling oral microbiome complexity.
1,5	Expectations	The student should have good programming skills (Python)
1,8	Research Tags	omics data, computational modelling & oral health
1,9	Programmes	Computational Science
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