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General Topic: Microbial Community Living

1. Please enter the address as a hyperlink (press space bar after pasting to activate link):

<https://www.miragenews.com/probing-periplasmic-biosynthesis-potential-1055998/>

2. What is the title of the article:

Probing Periplasmic Biosynthesis Potential: Chinese Academy

3. In 75-150 words, single-spaced, what are the main significant scientific findings of the article? Why are these findings important and how do they affect society/medicine/etc.?

Research from Yiliang et al. highlighted the discovery of semiconductor nanoclusters in the periplasm of Gram-negative bacteria. The researchers found that through the process of biomineralization, in which living organisms make minerals resulting in mineralized tissues, tiny semiconductors can form in the periplasmic space. This space between the inner and outer cell membranes of Gram-negative bacteria is ideal for biomineralization because it is rich in enzymes and is closely connected to the electron transport chain. Semiconductor nanoclusters could have many significant applications including constructing living bioreactors, capable of transforming raw materials into biochemical products, and generating semi-artificial photosynthesis. Through semi-artificial photosynthesis, Gram-negative bacterial cells such as *E. Coli* could remove carbon dioxide and other pollutants from the atmosphere, improving environmental remediation efforts and helping fight the effects of climate change. These findings could have a significant influence on the future of bioremediation, but further investigation of the periplasmic space is still needed.

4. In 75-150 words, single-spaced, explain which specific concepts you are learning in this unit helped you understand ideas from this article.

The article discusses the discovery of semiconductor nanoclusters within the periplasmic space of Gram-negative bacteria. In this chapter, we learned about Gram staining and how different characteristics of a bacteria's cell membrane categorize it as either Gram-positive or Gram-negative. Researchers from the Chinese Academy of Sciences and the University of Chicago discovered the potential of biomineralization in the periplasmic space of Gram-negative bacteria, involving the process of decomposition of inorganic substances. Through comparing the periplasmic space of Gram positive and negative bacteria, we learned that the Gram-negative periplasm includes abundant enzymes and little peptidoglycan between the inner and outer membrane. We also learned that the periplasmic space is home to the electron transfer chain used in metabolic processes to create ATP. This energy in the periplasm is another reason for the potential of reducing heavy metal content, living bioreactor fabrication, environmental remediation, and semi-artificial photosynthesis. Overall, the article helps us to further strengthen concepts learned in class.

5. In 75-150 words, single-spaced, imagine what you would say about this story to a friend or family member who is not a microbiologist, being sure to make the content engaging and accessible.

Scientists discovered that bacteria can efficiently produce various compounds by taking up minerals within the periplasm, a small factory-like space that is located between the inner and outer cell membranes of Gram-negative bacteria. These compounds are beneficial. They are used in medicine, recycling, and could be made without waste. To understand how bacteria are capable of producing these useful chemicals, scientists are trying to figure out the mechanism of semiconductor nanoclusters which could be compared to a group of workers that make the factory, periplasm, so efficient and sustainable. Once researchers figure this out, we could have various medications produced at rapid rates without by-products, which would have to be isolated from a desired compound. These factory workers also have the potential to conduct semi-artificial photosynthesis which would be more efficient than natural photosynthesis, conducted by plants, thus reducing the carbon in our atmosphere and fighting against climate change.

6. In 50-100 words, did you identify any obvious misconceptions, inaccuracies or omissions that could confuse the general public? What were they? If no clear issues exist, what microbiology concepts would be helpful for people to know as they read the article? Be sure to cite ideas from this class.

The article's language is highly scientific, making it difficult for the general public to comprehend. However, considering that the article was published in a scientific magazine, it is likely aimed towards an audience with an extensive underlying knowledge of microbiology. For those that are not as familiar with the topic, it would be helpful to learn about the process of biomineralization, as it highlights the importance of the semiconductor nanoclusters that are referenced throughout the text. Additionally, knowledge of the major structural differences between gram-negative and gram-positive bacteria is crucial in grasping why gram-negative species are the focus of this research.

## References

Chinese Academy of Sciences. (2023, July 28). Probing Periplasmic Biosynthesis Potential: Chinese Academy. *Mirage*. Retrieved October 11, 2023 from <https://www.miragenews.com/probing-periplasmic-biosynthesis-potential-1055998/>

Wessner, D. R., Dupont, C., Charles, T. C., Neufeld, J. D. (2017). *Microbiology*. John Wiley and Sons.