

# Review of the Literature on Oyster Bed Microbial Communities

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## Introduction to the microbial world

In a narrative that usually centers around plants, microorganisms are the unsung heroes of primary production. They work on a scale we cannot see, but the effects of their cumulative efforts are impossible to miss. Half of the oxygen in each breath we take has been produced by oceanic microbes (Pomeroy et al., n.d.). But who learned that in high school Biology?

Let's start by meeting the three domains of life: Bacteria, Archaea, and Eukarya. In the classification system (domain, kingdom, phylum... , species), domain is the broadest level of distinction. As humans, we belong to the domain Eukarya, along with all other organisms whose cell(s) have genetic material enclosed in membrane-bound nuclei. In other words, in the most basic deliniation between all life forms present on Earth, we, in all of our complexity, are grouped with plants, fungi, and many microbial species (including some single-celled microbes), while the two remaining categories are not only exclusively microbes, but exclusively prokaryotic<sup>1</sup> microbes.

Instead of performing metabolic pathways from start to finish, like how food is passed from mouth to esophagus to stomach to small intestine, etc., in our digestive systems, microorganisms are reliant on each other to achieve comparable biological processes. Take a look at the denitrification step of the nitrogen cycle, which—among other applications—is facilitated by microbial communities in the marine sediments associated with oyster farms: nitrate ( $\text{NO}_3^-$ ) is converted by \_\_\_\_\_ to nitrite ( $\text{NO}_2^-$ ) \_\_\_\_\_ which is converted nitric oxide (NO) by \_\_\_\_\_ and then to nitrous oxide ( $\text{N}_2\text{O}$ ) by \_\_\_\_\_ and finally to dinitrogen ( $\text{N}_2$ ) by \_\_\_\_\_. Each microorganism in this pathway has a unique enzyme that catalyzes one particular reaction in the sequence, with the collective result being denitrification.<sup>2</sup> Dr. Lawrence Pomeroy describes these community behaviors as “external digestive processes [which] provide shared benefits for motile bacteria” (Pomeroy et al., n.d.). Dr. Farooq Azam simplifies this further, calling microbial communities the “ultimate swimming stomachs” (Pomeroy et al., n.d.).

\*Need to fill in species' names

When we talk about the factors at play regulating ecological systems, when we talk about the cycling of nutrients between earth, water, sky, and us, it does us well to acknowledge that the drivers of biological processes are microorganisms. It's a microbial world; we're just living in it.

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<sup>1</sup>Prokaryotes: Unicellular microbes with free-floating genetic material in their cytoplasm. They can have organelles, like ribosomes (which all organisms have) or flagella (little extracellular hairlike-structures that enable movement for cells), but they do not have membrane-bound organelles. A prokaryotic cell is like DNA/RNA-cytoplasm soup.

<sup>2</sup>More on this later. Denitrification is an important aspect of the role that sediment microbes in oyster beds play as water purifiers.