The Effects of PolyDOTs on Eastern Oyster, *Crassostrea virginica*

Daniel J. Smith\(^1\), Nicole H. Levi-Polyachenko\(^2\), Amy H. Ringwood\(^1\)

\(^1\)Department of Biology, University of North Carolina at Charlotte

\(^2\)Department of Plastic and Reconstructive Surgery, Wake Forest University

Layperson Summary:

The world we live in is full of new technologies and new materials are introduced to commercial markets every day. With these new technologies come new pollutants. Nanoparticles are being incorporated into many of the new products that we have today. Silver nanoparticles are incorporated into athletic clothes because of their ability to kill bacteria and help control odors. Titanium dioxide nanoparticles are found in sunscreens and many personal care products due to their ability to reflect the sun’s harmful UV rays. With their increased use, nanoparticles are now being found freely in the environment.

This research focuses on a class of nanoparticles that is being studied as a potential cancer treatment, better known as PolyDOTs. PolyDOTs work by attaching to cancer cells and then create temperatures high enough to locally kill the cancer cells when infrared energy is applied. However, these PolyDOTs are thought to be stable and not broken down during the treatment process and when used on a mass scale they will be found in the environment. The actions of PolyDOTs as a pollutant are not very well understood. This research aims to help identify the effects that PolyDOTs will have on organisms in aquatic environments.

For this research, the effects of PolyDOTs as a pollutant are being studied on oysters. Oysters make good model organisms because they filter water and collect their food from the water that is being filtered. However, during the filtering process any pollutant that is present in the water is coming in contact with the oysters. Whole oysters and isolated oyster tissues are being exposed to different concentrations of PolyDOTs and multiple toxicity assays are being used to determine how toxic the PolyDOTs are. Also, the differences in toxicity between PolyDOTs exposed to the sun and those that have not been exposed to sunlight are being tested. Sunlight contains many wavelengths of light other than visible light and it is thought that the same property of PolyDOTs that allows for the destruction of cancer cells could be activated by one of these wavelengths. This poses the potential threat of making toxicity worse in the environment and this research will help to determine the differences in toxicity between PolyDOTs exposed to the sun and those that are not.

This research is important for helping to better understand the effects of PolyDOT nanoparticles as environmental pollutants. It is important that we understand the impacts that new technologies, such as nanoparticles, have on the world in which we live. These broader impacts other than the intended uses of technologies are often overlooked. Not knowing the broader impacts of a technology has shown to be fatal many times throughout history. One of the most famous examples of this was with DDT, a once widely used pesticide. The chemical quite effectively killed insects, but it also weakened the shells of many bird eggs and sent one of America’s most prized treasures, the bald eagle, to near extinction. It would be a shame for a similar situation to occur with PolyDOTs and other nanoparticle products, and this research will provide initial observations of how the PolyDOTs will act as pollutants. This study, along with the multitude of other nanoparticle studies, will provide important new insights to insure the responsible use of nanoparticle products.