Metallic Implants for Nitric Oxide Generation

*Federico Mazur, Yingzhu Zhou, and Rona Chandrawati**

School of Chemical Engineering and Australian Centre for Nanomedicine (ACN)
The University of New South Wales
Sydney, NSW, Australia
federico.mazur@unsw.edu.au, rona.chandrawati@unsw.edu.au

The most commonly used systemic drug delivery systems in medicine include oral ingestion, intravenous injection, and transdermal application. Despite their popularity, they are limited by issues such as first pass metabolism, patient compliance, undesirable side effects on target tissue, and/or low dosage at target site.[1] Alternative strategies have been developed to overcome these issues, one of which includes implantable drug delivery systems.[2] Currently, out of the various materials available, metallic-based implants are the most widely used and are considered a reliable choice in the healthcare field, however, they tend to suffer from bacterial contamination on their surface.[3] Consequently, the ability for localized antibacterial drug delivery has become essential.[4] Nitric oxide (NO) is a well-known antibacterial agent that can be used for this application.[5] We have developed a heat treatment method that imparts metallic implants with the ability to perform highly efficient catalysis generation of NO (Figure 1). The NO generation was tuned by varying the implant dimension, NO prodrug concentration, and heat treatment conditions. Among the different types of metallic implants investigated, stellite alloys maintain their catalytic activity over several cycles, allowing for long-term sustained NO delivery. Furthermore, antibacterial properties and cell viability were demonstrated. This study demonstrates a rapid and simple method to provide antibacterial properties to metallic-based implants.

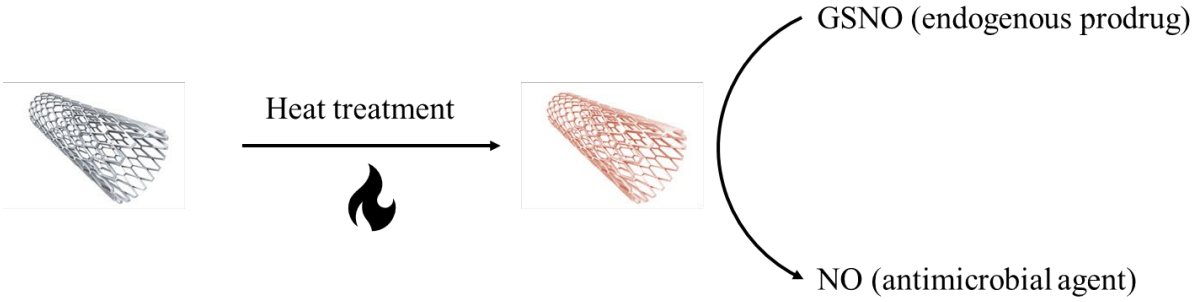

Figure 1: Schematic diagram of metallic implants demonstrating catalytic properties upon heat treatment towards endogenous prodrug degradation for nitric oxide generation.

References:

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[3] Flemming, H-C.; et al. *Nature Reviews Microbiology* **2016**, *14*, 563-575.
[4] Koo, H.; et al. *Nature Reviews Microbiology* **2017**, *15*, 740-755.
[5] Schairer, D.; et al. *Virulence* **2012**, *3*, 271-279.