Building better bone replacements with bacteria

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Bacteria that manufacture hydroxyapatite (HA) could be used to make stronger, more durable bone implants. Professor Lynne Macaskie from the University of Birmingham this week (7-10 September) presented work to the Society for General Microbiology's meeting at Heriot-Watt University, Edinburgh.

Using *Serratia* bacteria, the research showed that the bacterial cells stuck tightly to surfaces such as titanium alloy, polypropylene, porous glass and polyurethane foam by forming a biofilm layer containing biopolymers that acted as a strong adhesive. The HA coating then builds up over the surface. For practical use, the HA layer must stick tightly, then the material is dried and heated to destroy the bacteria. A micro-manipulation technique used to measure the force needed to overcome the bioglue adhesion showed that dried biofilm stuck 20-times more tightly than fresh biofilm. When coated with HA the adhesion was several times more again. Slightly roughening the surface made the bioglue much more effective.

Currently bone implant materials are made by spraying-on hydroxyapatite. This does not have good mechanical strength and the spraying only reaches visible areas. This biocoating method reaches all the hidden surfaces as the bacteria can "swim" into hidden nooks and crannies. Bacterial HA also has better properties than HA made chemically as the nanocrystals of HA produced by the bacteria are much smaller than HA crystals produced chemically, giving them a high mechanical strength.

"The bacteria are destroyed by heating, leaving just the HA stuck to the surface with their own glue - rather akin to a burnt milk-saucepan," said Professor Macaskie, "We need to do more work actually to turn the materials into materials we can use in biomedicine and the environment. Then they need to be tested in real life situations with clinical and environmental trials."

Source: Society for General Microbiology