

**E3B**The Elements of
Bioremediation,
Biomanufacturing
& Bioenergy**Metals in Biology**PROJECT PARTNERS: Jon Lloyd and Vicky
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MANCHESTER
1824

The University of Manchester



Microbial recovery of e-tech metals

“Mint has a sustained interest in harnessing microbes to help recover metals, yet our company lacks cutting-edge imaging and characterisation tools, so a longer-term collaboration will help better elucidate metal capture mechanisms.”

PROJECT AIMS: The project is a collaboration between Mint, a cleantech start-up working on the recovery of valuable materials from urban-mine feedstocks such as electronic waste, and the geomicrobiology group at the University of Manchester who have expertise in and access to anaerobic metal-reducing bacterial cultures. The aim of the project is to facilitate a mapping exercise around e-waste metal biorecovery, identifying where the commercial and academic partners can benefit from further collaborations. The work includes:

- (1) Testing Mint leachates against Manchester cultures.
- (2) Identifying mechanisms of metal recovery and metallic nanoparticle formation.
- (3) Assessing market opportunities for the produced products.

OUTCOMES & NEXT STEPS:

- Work is being continued via a new engineering biology project: ‘Engineering Microbial Metal Recovery: EMMR’ (BB/W014351/1), which was developed directly from work initiated via this Business Interaction Voucher.
- Optimised processes from the University of Manchester are being tested against Mint waste streams and being improved using engineering biology approaches to enhance recovery via an iterative programme of work.
- The academic partner is involved with discussions to support future work in the UK with Mint, including investigating a wider range of waste

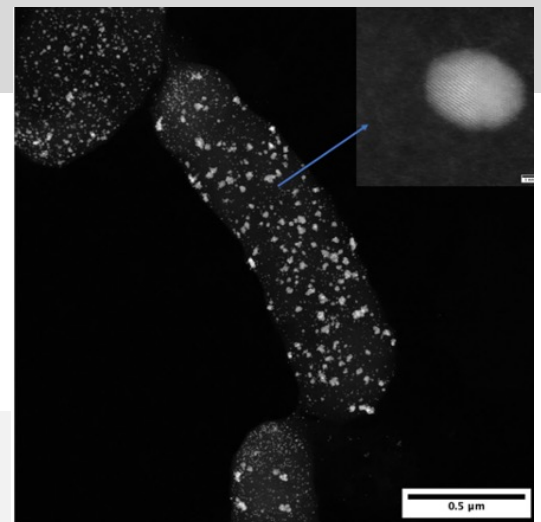
RESULTS: The project supported close contact between Mint and the University of Manchester, supporting metal recovery (especially gold) from e-waste leachates.

The capacity of metal-reducing bacteria (*Shewanella oneidensis*) to reduce Au(III) and recover it as nano Au(0) was tested against process solutions representative of those generated by Mint. The work included:

- Optimising electron donors for rapid metal bioreduction at realistic Au(III) concentrations.
- Assessing the impact of co-contaminants and pH of leaching solutions on metal recovery.
- Determining the impact of buffer on the bioprocess.
- Characterising end-products, including assessing the impact of process conditions on particle size and Au(0) localisation.

Overall, the *Shewanella oneidensis* system was optimised using synthetic test solutions in this project, and work on real industrial leachates is continuing using follow-on funding.

Change in technology readiness level: 1 to 2/3



Electron micrograph showing gold nanoparticles (light precipitates) recovered from solution by the bacterium *Shewanella oneidensis*.