Institution: University of Wolverhampton

Unit of Assessment: 3 – Allied Health Professions, Dentistry, Nursing and Pharmacy

Title of case study: Creating jobs and profits through microbiology knowledge transfer into SMEs

1. Summary of the impact (indicative maximum 100 words)

The case study examines the impact of the development of this knowledge and research expertise in microbiology upon the growth and development of small business enterprises (SME) regionally and internationally. The impact reported relates to a number of businesses who at the time lacked key knowledge and expertise in microbiology but who, as a consequence or working with the microbiology team at Wolverhampton, have increased their capability and presence within an ever- increasingly competitive market.

2. Underpinning research (indicative maximum 500 words)

Microbiology research at the University of Wolverhampton has focussed upon studying the interrelationships between microorganisms and the environment that focusses on a small number of key areas. Research into the evaluation of natural and synthetic antimicrobials, microbial survival in liquid and surface environments, and biosynthesis of natural biopolymers has provided the applied microbiology skills to directly, or indirectly, support business needs relating to microbial spoilage control and new product development.. The key researchers associated with this case study are Dr David Hill (joined 1987) and Dr Iza Radecka (joined 2001) supported by Professor of Inorganic Chemistry, Craig Williams.

Previous research by this group focussed on epidemiology, growth and survival of enteric pathogens. This expertise has continued but with a focus on the microbial control of other organisms in their environment. Antimicrobial properties of garlic (Ref 2), and other plant extracts, has been a focus of the group and has developed to include synthetic antimicrobials and combinations (Ref 3). This, along with early PhD work on detergent and disinfectant effectiveness (Ref 1), provided the group with necessary applied microbiology skills for understanding interrelationships between microorganisms and the environment. The development of knowledge of how environmental factors, such as presence of other chemicals, their concentration, and medium (eg liquid, gel or surface) influenced microbial survival, led to understanding how microorganisms could be controlled and evaluated. This provided the platform upon which to engage in applying this knowledge to specific company-based problems of: microbial spoilage and biodegradable detergents with Rozone Ltd; bioaerosol determination in waste recycling with Crestwood International Ltd; and microbial control of odours with Odour Services International Ltd.

3. References to the research (indicative maximum of six references)

1. Walton, J.T., Hill, D.J., Protheroe, R.G., Nevill, A. and Gibson, H. (2008). Investigation into the effects of detergents on disinfectant susceptibility of attached E. coli and L. monocytogenes. Journal of Applied Microbiology, 105, 309-315. ISSN: 1364-5072

2. O'Gara, E. A., Maslin, D. J. and Hill, D. J.(2008). The Effect of Simulated Gastric Environments on the Anti-Helicobacter activity of Garlic Oil. Journal of Applied Microbiology 104, 1324-1331. ISSN: 1364-5072

3. Low, W.L., Martin, C., Hill, D.J. & Kenward, M.A. (2011). Antimicrobial Efficacy of Silver Ions in Combination with Tea Tree Oil Against Pseudomonas aeruginosa, Staphylococcus aureus and Candida albicans. International Journal of Antimicrobial Agents, 37, 162-165. ISSN: 0924-8579

4. Details of the impact (indicative maximum 750 words)

Microbiology research at Wolverhampton generated the knowledge and understanding to support regional SMEs through consultancy projects to resolve microbial spoilage issues or procedures for evaluating microbial presence/growth. This led to three Knowledge Transfer Partnership (KTP)

awards with Rozone Limited, Crestwood Environmental Ltd and Odour Services International Ltd, that impacted upon those businesses and surrounding communities.

Rozone Ltd

KTP project with Rozone resolved microbial spoilage issues and went on to research and develop environmentally-friendly biodegradable cleaning agents.

The project (completed 2009) employed graduate Rowe to embed microbiological and chemical knowledge into the company to develop own brand products for sustainable, environmentally-friendly cleaning systems for recycling car parts. This would replace conventional toxic solvent cleaning with biodegradable detergents and a bacterial treatment system for oil and detergent biodegradation. The project was an immense success developing 'Own Brand' products as alternative to original overseas supplier; seven new products and improved production capability. The project culminated in Rozone purchasing a chemical mixing company at Deeside, the acquisition of which increased finished products production by 180% (http://www.cihe.co.uk/wp-content/uploads/WolverhamptonCaseStudy13.pdf). Microbiological and chemical knowledge gained during the KTP was instrumental in redesigning production facilities at Deeside. Thus, quality control procedures were implemented that ensured accurate formulation and reduced microbial contamination through design, quality control laboratory implementation and effective management. The project achieved its objectives for enhancing Rozone's science knowledge base (Rowe employed as QC Manager/Technical Advisor) and facilitated growth through 'Own Brand' and new product developments. The project led to 35% new clients, increased company profits of £100,000 within 3 years and improved quality control systems saving additional £20,000 (Refs 1, 2). This also led to increased employment opportunities (15-20 additional staff) for communities at Wednesbury and Deeside (high unemployment areas). Rowe achieved a KTP Business Leader of Tomorrow Award beating national competition from 100 Associates. The DTI rated the project as 'Outstanding' (Ref 3).

Crestwood Environmental Ltd (CEL)

CEL, an environmental consultancy company, provide site evaluations for clients nationally. Consultancy work with CEL on bioaerosol pathogens led to a KTP project developing monitoring systems for bioaerosols (bacteria and fungi) from waste processing sites (completed 2011), essential for ensuring that local residents/factory workers were not subjected to health risks. CEL initially lacked scientific knowledge/skills to interpret microbiological data and for developing new analytical methods. This limited microbiological consultancy work and prevented the company from pioneering new consultancy provision in this area. The project helped the company become more competitive through a recession period, leading them to the forefront of their business with greater knowledge support for clients and, increased market opportunities through provision of new analytical services. The company increased sales turnover by £30,000 with increased profits of £10,000 during the KTP (Refs 6, 7).

The value of this work was highlighted by CEL achieving runner up prize for the Lord Stafford Award for 'Innovation in Development' in 2010 (Ref 4). An international conference presentation (Ref 5) by the Associate (Hall) gave the company a research reputation and gained recognition by the Environment Agency (EA) as a lead company for bioaerosol monitoring with CEL now invited to EA bioaerosol policy-making meetings (Ref 9).

This success has led to award of a second KTP with CEL to research biological odour measurement.

Odour Services International Ltd (OSIL)

A KTP award (2012) with OSIL is harnessing bacterial capability to remove sulphide and other odour compounds from waste treatment sites. Hill transferred bacterial growth and survival knowledge and skills to OSIL via KTP Associate (Low) to formulate new biofilter designs and provide scientific understanding behind existing systems. This resulted in: expert scientific support at client business meetings that clinched £300,000 of new contracts; developed OSIL-owned bacterial inoculants that led to £620,000 new business; extended shelf-life, freeze-dried inoculants saving £15-20,000 on out of date stock and £55,000 on customer retention through rapid response

to problems (Ref 8). Associate Low nominated for KTP Business Leader of Tomorrow Award beat over 100 associates to the final (subsequently identified as a winner).

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. http://www.wlv.ac.uk/default.aspx?page=23854
2. Rozone KTP Final Report (2009), confidential KTP Report available on request
3. http://www.wlv.ac.uk/default.aspx?page=21393
4. http://www.crestwoodenvironmental.co.uk/General.html
5. Hall, S., Gibson, H., Lambert, A.M., and Hill, D.J. (2011). Bioaerosol Monitoring – a Practical Evaluation. 16th European Biosolids & Organic Resources Conference Proceedings 14th-16th November, Leeds. Oral paper presentation
6. Crestwood Environmental Ltd Final Report (2011), confidential KTP Report available on request
7. http://www.wlv.ac.uk/default.aspx?page=33380
8. Odour Services International Ltd KTP Awards Report 2013, confidential KTP Report available on request.
9. EA Biaerosol Sampling Workshop 2013