Workshops kickstart a *Rhodococcus* molecular toolkit

Workshops funded by Metals in Biology BBSRC NIBB have built a new community of scientists involved in *Rhodococcus* research and initiated a project to develop a community resource of molecular biology tools to enable the wider use of *Rhodococcus* bacteria in industrial biotechnology.

Rhodococcus species — the majority of which are non-pathogenic soil inhabitants — contain useful enzymes, pathways and systems that can be harnessed for industrial biotechnology applications. For example, they are able to breakdown environmental pollutants and explosives, aid the recycling of rubber tyres, be used in biofuel production systems, turn metal contaminants into useful products and synthesise complex chemical compounds.

A scoping workshop on "Metalloproteins in Biocatalysis and Bioenergy" was held at Durham University in July 2014; not long after the start of the Metals in Biology Network. At this meeting, Alison Parkin from the University of York and Colin Murrell from University of East Anglia, advocated the idea of holding a focused workshop on *Rhodococcus*. "We realised that there were a number of research groups in the UK who were working on *Rhodococcus* and related genera of actinomycetes, and that there was common interest in the biology, molecular genetics and the potential for biotechnological applications of this group of bacteria," says Colin.

Alison highlights that that *Rhodococcus* research is an area where the UK has both strength and breadth, "UK science in this area spans industrial applications, environmental science and understanding disease". A key consideration was the format of the focused meeting to help maximize potential output. "I wanted to have a meeting where attendees could have chance to get to know the main players in this field in a very focused, friendly and open manner that would let us discuss future directions and find new ways of working as a strong team," says Alison.

The meeting, held at the University of York in November 2015, had about 20 attendees (a summary of the meeting is available here). As well as allowing academic researchers and industry scientists to mix, the meeting initiated new projects. For example, as a result of the meeting, Alison's lab will now be able to start studying new bacteria and enzymes to find new biocatalysts that activate challenging chemical reactions.

One key theme that emerged at this meeting was the paucity of molecular biology tools (such as plasmids, vectors and mutagenesis protocols) to extract and manipulate *Rhodococcus* enzymes to enable their optimization for research and industrial biotech applications. To address this challenge, the attendees proposed the establishment of a molecular tool kit for *Rhodococcus*.

This idea was championed by Jon Marles-Wright and Louise Horsfall from the University of Edinburgh. "Building a molecular biology toolkit, based on established synthetic biology standards and containing well characterised parts for the control of gene expression and genome editing, will enable us to use *Rhodococcus* species more widely as an industrial host," says Jon. "It will also speed up research by making the tools available freely to anyone interested in working with these strains".

To initiate this project, Jon collated information related to *Rhodococcus* strains, genomes and genetic tools used in the attendees' research groups. The next phase of the project is moving into the lab; during the summer of 2016, Jon and Louise have a group of Masters students who are competing in the iGEM competition – an international synthetic biology completion for early career scientists.

"The iGEM competition has an ethos of openness and collaboration, so the idea of developing a set of community tools to enable *Rhodococcus* species to be easily engineered and used in research and industrial settings was something that really appealed to our students", says Jon. The plan is for part of the team to focus on a *Rhodococcus* toolkit, with the *Rhodococcus jostii* RHA1 strain as their model system. The students will also be involved in maintaining the community of *Rhodococcus* researchers.

So as a result of the workshops, the community-building that researchers hoped to achieve has indeed worked and they are now starting to construct a shared resource for molecular biology tools in *Rhodococcus*. "This has been a brilliant result", concludes Alison.

Attendees at the *Rhodococcus*-focused workshop

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