2016 National Research Infrastructure Roadmap
Capability Issues Paper

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Thank you for the opportunity to respond to the 2016 National Research Infrastructure Roadmap Capability Issues Paper. I work in advanced manufacturing and the design and development of medical devices. I direct an ARC Research Hub that carries out research that depends on access to state of the art microscopy and microanalysis tools. For the sake of brevity, I have answered only the questions I consider relevant to my activities, below.

Questions

Question 15: Are the identified emerging directions and research infrastructure capabilities for Health and Medical Sciences right? Are there any missing or additional needed?

I am the Director of the ARC Research Hub for Advanced Manufacturing of Medical Devices. The impact of this research hub spans two of the categories listed in the capability Issues paper: Health and Medical Sciences; and Advanced Physics, Chemistry, Mathematics and Materials. The research outcomes are the commercial manufacture of customised high value endovascular aneurysm repair products (i.e. stents to treat heart disease) and associated revenues and job creation due to increased market share for our major Australian partner, Cook Australia, and its supply chain (including Heat Treatment Australia, Bosch and Advanced Materials Solutions). Tailoring devices for individual clinical needs will deliver better health outcomes for patients and improved surgical accuracy. A higher skilled workforce will be developed particularly in SMEs with flow on benefits to other manufacturing supply chains.

We have been awarded $4.9 million in support for this project over 5 years, including nearly $3 million in funding from the ARC. Advanced microscopy is essential to this work, and we will access facilities operated by the Australian Microscopy and Microanalysis Research Facility (AMMRF) at the University of Queensland and the University of Sydney. In particular, in the coming years, we will require access to the latest generation of high-resolution transmission electron microscopy and atom probe tomography tools, described in more detail in my response to the following question.

Advanced Physics, Chemistry, Mathematics and Materials

Question 21: Are the identified emerging directions and research infrastructure capabilities for Advanced Physics, Chemistry, Mathematics and Materials right? Are there any missing or additional needed?

Our ARC Research Hub aims to transform Australia's $10.8Bn medical technology sector by developing cost competitive technologies for the rapid production of personalised devices (stents) for Endovascular Aneurysm Repair (EVAR). To ensure that the Australian industry remains globally competitive, the Hub seeks to concurrently develop materials, technologies and flexible manufacturing processes. The intended outcomes include more efficient design and manufacturing processes and a new range of EVAR products generating increased market share and higher workforce capability. The resulting impacts are better health outcomes, job creation and providing SMEs with new technologies and skills that can be transferred to the manufacture of products for other sectors.

Central to this work is the development of new advanced near-net shape manufacturing technology, new materials for enhanced joining to grafts, and novel wire compositions. This work depends on high-level microscopy to relate processing to microstructure and the resulting stent properties. In particular, our work will benefit greatly from access to new-generation aberration-corrected transmission electron microscopy, high efficiency atom probe microscopy and high-sensitivity microanalytical tools such as secondary ion mass spectroscopy. The most up to date generation of these technologies are not readily available to our research team.

In the coming years, access to these instruments will be essential for materials scientists, condensed matter physicists, chemists and biomedical engineers across Australia. The high-end instruments can cost up to $10 million, and are beyond the scope of normal University or ARC investment. I sincerely hope that NCRIS will provide access to this instrumentation. It has certainly been my expectation in applying for ARC support that I would have access to state-of-the-art research infrastructure for my ongoing work.

The AMMRF proposes to update their grid of open-access state-of-the-art microscopy infrastructure to includes the technologies I have listed above. My research has benefitted enormously from access to the current generation of instruments that are openly available through the AMMRF, and I would like to advocate that NCRIS support renewed investment in the AMMRF suite, both to enable my research team to benefit from to open access facilities across Australia, and to provide us with access to the new generation of research capabilities we require to be successful in our work.