Please note: the substantive content of the 2026 NRI Roadmap Survey begins at Question 20 (with prior questions dealing with administrative and other information).

As such all submissions that are published include the responses submitted from Question 20 onwards only.

Q20.

Part 2: Research themes

2.1 NRI comprises the assets, facilities and associated expertise to support leading-edge research and innovation in Australia and is accessible to publicly and privately funded users across Australia and internationally. We are seeking your input on possible directions for future national-level investment - i.e., where the requirements are of such scale and importance that national-level collaboration and coordination are essential.

The 2021 Roadmap used a challenge framework to support NRI planning and investment. With this in mind, consider likely future research trends in the next 5 - 10 years, and with respect to one or more of the 8 challenge areas identified in the 2021 Roadmap as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or not at sufficient scale and
- describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities.

Q21.

Resources Technology and Critical Minerals Processing

Q22.

Food and Beverage

Q23.
Medical Products

Q24.
Defence

Q25.
Recycling and Clean Energy

Q26.
Space

Q27.
Environment and Climate

Q28.
Frontier Technologies and Modern Manufacturing

Q29.

2.2 The 2024 statement of National Science and Research Priorities (NSRPs) includes outcomes linked to each priority to assist in identifying critical research needed in the next 5 to 10 years.
Consider the priority statements and, with respect to one or more of the 5 priority areas as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or
- not at sufficient scale and describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities, and where relevant, refer to the underpinning outcomes and research identified in the NSRPs document.

Q30.

Transitioning to a net zero future

Q31.

Supporting healthy and thriving communities

Increased capability to enable correlative and multimodal microscopy solutions for more complete, multiscale and integrated data from samples across the discipline spectrum, especially in the biomedical sciences. New developments in more integrated systems would enhance our ability to capture these types of data, and then to provide support for analysis of these complex data sets.

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Q33.

Protecting and restoring Australia’s environment

Q34.

Building a secure and resilient nation

More of the important every-day-use microscopes and staff are needed to enable an increased national focus on translation of academic research into useful products through spin-out companies and licensing agreements. There have recently been situations where spin-outs with microscopy needs have been turned away from our facilities based solely on instrument and staff capacity. Only more instruments and skilled staff can resolve this block and enable us to facilitate increased translation outcomes.

Q35.

2.3 The case for a new NRI capability, or enhancements to existing capabilities, typically emerges through advocacy from research communities clustering around rigorously identified needs and goals. Such a concept could respond to a requirement for novel or expanded capacity within a domain, or across domains, and must be such that it could only be made available with national-level investment.
If you have identified such a requirement, briefly describe the need, the proposed infrastructure capability, the medium-term goals, impacted research communities, and the timeframe over which you advocate its establishment. Your response can include links to relevant existing reports.

Volume Electron Microscopy or volume EM (vEM) refers to a group of recently developed imaging approaches that use scanning and transmission electron microscopy (SEM and TEM) to allow interrogation of cell and tissue ultrastructure in 3D, at µm to mm volume scales and nm resolutions. A movement started in the UK and Europe is represented in this webpage: https://www.volumeem.org/ and in this publication: https://www.nature.com/articles/s43586-022-00131-9. Within Australia, we have a strong contribution to vEM including instrumentation and expertise. Our Australian community is represented by both Microscopy Australia and by the special interest group of the Australian Microscopy and Analysis Society called Volume Imaging Australia (VIA). As President of this group, we make it a priority to retain close ties to the global vEM community and to locally strengthen our community. We achieve this by sharing knowledge, experience and resources to improve access, reliability, throughput and training of vEM techniques and methodologies. There is vEM instrumentation and expertise distributed across Australia. vEM instrumentation includes the microscopes (Serial Blockface Scanning Electron Microscopes, Focused Ion Beam Scanning Electron Microscopes, Scanning Electron Microscopes (with software capabilities for complex imaging strategies) and Transmission Electron Microscopes (with software capabilities for complex imaging strategies)); the sample preparation instruments (processing microwave, MicroCT, high pressure freezers), skilled staff and strong computing infrastructure. For biological specimens the sample preparation is as critical as the instrumentation. The same can be said for the data management across these techniques which generate large volumes of rich informative data. Where access is given to already existing facilities that are experienced in vEM, researchers can benefit from efficient application of these complex workflows in their areas of research. At the University of Queensland, the Centre for Microscopy and Microanalysis is well equipped in vEM from project design through to microscopy and final image analysis. As are other facilities across Australia, including Sydney Microscopy and Microanalysis (SMM) at the University of Sydney and Bio21 Molecular Science & Biotechnology Institute, at the University of Melbourne. The Centre for Microscopy Characterisation and Analysis at the University of Western Australia is currently procuring their own SBFSEM system to equip the west coast. Together we form the foundation for vEM capabilities across Australia and my hope is to see that these facilities including their staff continue to be supported and recognised for our contribution to research excellence.

Q36.

Part 3: Industry perspectives

This section is seeking input specifically from industry-based respondents. Other respondents can skip this section.

Recommendation 6 of the 2021 Roadmap related to improvements in industry engagement with NRI. To complement work on this topic that has occurred since then, we are seeking additional advice on NRI requirements as perceived by current or potential industry-based users.

Q37.

3.1 Have you (or your organisation) interreacted with or used Australia's NRI?

- (●) Yes
- ( ) No

Q38.

3.2 If so, please briefly outline the NRI capabilities you (or your organisation) have interacted with or used. Do not limit your response to NCRIS capabilities.

As manager of a microscopy laboratory, we have many research projects that span across microscopy scales and require collaboration with other instrumentation outside of our centre. I regularly use the Yxlon FF35T in the Centre for Advanced Imaging, UQ which is a National Imaging Facility. This instrument is critical to the correlative workflow where we are able to target and image with electron microscopy a very specific region of interest in any sample. This means that an identified area in either live or fixed biological specimen can be efficiently targeted to image at high resolution across a spectrum of electron microscopes (for example, Serial Blockface Scanning Electron Microscope, Transmission Electron Microscope or Focused Ion Beam Scanning Electron Microscope). The correlation across scales gives valuable information at each step. Optical Microscopy gives a snapshot of the live specimen tagged with specific labels; microCT gives the context of the whole specimen or larger area for targeting; the electron microscope gives the high resolution full detail of that same biological specimen. This technique is one example of correlative microscopy which can be applied to samples other than in the life sciences, something that we are actively exploring. Being part of the Centre for Microscopy and Microanalysis at the University of Queensland gives us a unique position, we are at the heart of the ongoing research at UQ and collaborate closely with other facilities across UQ to ensure that the research question drives the microscopy technique used.

Q39.

3.3 Please indicate your (one or more) primary reasons for interacting with NRI:

- [ ] For expertise or advice
- [x] Access to research resources or products
- [x] Access to equipment for research
- [x] Access to equipment for operational reasons
- [x] Help in translating research
- [ ] Access to data
- [ ] Support for clinical trials
- [ ] Other (please specify)

Q40.

3.4 If you answered no, please indicate your (one or more) primary reasons:

This question was not displayed to the respondent.

Q41.

Part 4: Other comments

4.1 Please elaborate on any of your above responses or add any other comments relevant to the development of the 2026 Roadmap. Your response can include reference or links to existing reports that you recommend be considered during the 2026 Roadmap development process.

Microscopy underpins broad science disciplines, from medical, soft matter, plant, materials, agricultural and geological sciences, that require cutting-edge microscopy to address Australia's future research and industry needs. A significant uplift in advanced microscopy is urgently required across the country. The continuation of long-term investment (10+ years) in national research infrastructure, such as Microscopy Australia, is critical. A long-term, ongoing timeframe would ensure continuous high-level support for all Australian researchers from emerging early career researchers through to those in national flagship research programs, such as MRFFs, CRCs, ARC Centres of Excellence and Laureates, and NHMRC Investigator Fellowships. Interruption or stagnation of funding would have critical consequences for Australia's future. I am a manager of microscopy instrumentation, we support researchers that need microscopy across the life sciences and soft matter research areas. We see on a regular basis how our highly skilled and experienced staff are the cornerstone in not only maintaining this instrumentation but also ensuring that it is utilised to the highest standard. Without this long-term skilled workforce, researchers would not be able to acquire the quality of data that is necessary. Alongside supporting the microscopists, we need to support the existing instrumentation whilst also looking forward to the future. I most sincerely hope that Microscopy Australia is recognised for the fundamental underpinning infrastructure that it is and that the 2026 Roadmap recognises the critical need to increase funding to ensure continued research excellence by emerging and established Australian researchers.