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

Microscopy and Microscopy Australia will play an important role in this sector in the next 5 - 10 year period. The 2023-2030 Critical Minerals Strategy (https://www.industry.gov.au/sites/default/files/2023-06/critical-minerals-strategy-2023-2030.pdf) identifies several priorities in which microscopy provides unique resources to realize goals. This includes targets such as the support for a strong pipeline of new critical mineral discoveries and projects through government geoscience programs and strategic leadership under the developing strategically important projects item and training to promote the building of a skilled workforce.

Q22.
Food and Beverage

Q23.
Medical Products

Microscopy provides a unique tool to investigate the structure of materials that are developed in prosthetics, in dental products and pharmaceuticals. There will be a continuous need to develop this fields which are of high importance way beyond the 2030 target period. Microscopy uses a whole range of different approaches to surveys metals and alloys, resin and tissues in protheses as well as pharmaceuticals. Hence, often microscopy facilities provide a one stop shop in which a complete investigate a new material.

Q24.
Defence

Defence will continue to require the development of light alloys as well as whole array of different types of semiconductors for communication and energy generation. Microscopy provides a unique combination of characterization and visualization to understand the properties of these materials.

Q25.
Recycling and Clean Energy

Same as above. Microscope is unmatched in the capability to investigate the properties of semiconductors, 2D-materials for electronics as well as the properties of materials for the construction on the next generation of fusion and fission-based energy production facilities of the next generation throughout and beyond the 5 - 10 target of this survey. In addition, the production of novel photovoltaic materials with superior efficiency and lower cost is the main driving force for the continuous development of new detectors and high throughput instruments. These have been developed with the sole purpose to facilitate and speedup the investigation of easily damaged materials like organic perovskites used novel photovoltaics. The use of AI will also further speedup the analysis via microscopy and this will require a large amount of data to be generated and curated to train large language models to interpret the data.

Q26.
Space

The research necessary to produce new materials for aerospace technology again rely strongly in Microscopy. The production of light alloys and high efficiency photovoltaics required to reduce the cost of sending communication satellites depend on investigations uniquely provided by microscopy which can probe down to the nanometer scale and beyond required to understand and fabricate novel instrumentation for space exploration, land observation from space and communication.

Q27.
Environment and Climate

Q28.

Frontier Technologies and Modern Manufacturing

Step changes in manufacturing can only happen when there are extremely large gains in implementing new technologies. For instance, any changes in semiconductor technology require a complete overhaul of the fabrication. This can result in a huge expense that is only justified if the industry can recover its cost over a short period of time after updating its fabrication line. These step changes require years of research that is only accessible via the NRI facilities in special microscopy which can provide information down to the relevant scale required in semiconductor industry. Analog to this example is the manufacturing in renewables and automotive industry.

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

Transition to a net zero pass through the production of novel materials but also policies that incentivize and reduce the use of fossil fuels and forever chemicals. Specially on the materials side microscopy can support the next 5 to 10 years of research towards the production of novel photovoltaic materials and thermal materials for solar to electric energy conversion.

Q31.

Supporting healthy and thriving communities

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Q33.

Protecting and restoring Australia’s environment

Microscopy provides a unique way to identify and show details of both flora and fauna in Australia. Restoring Australia's national environment requires the re-introduction of locally occurring plants and animals that can be identified and characterized not only in relation to species but also origin via microscopy.

Q34.

Building a secure and resilient nation

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.

There are significant challenges ahead. Novel materials will play an important role in realizing net zero, in exploring our natural resources, in achieving faster communications. This will not only the maintenance of existing personal and equipment as well as the acquisition of microscopes with higher resolution, faster detection systems and integration with the national computational infrastructure to be able to deal with the large data to be analyzed.

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.

Microscopy Australia and National Computational Infrastructure

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
- [ ] Access to equipment for operational reasons
- [ ] Help in translating research
- [x] 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 researcher at ANU working in the field of Materials Sciences. Having access to Microscopy Australia's instruments, and the expertise that goes along with them, is vital to my research. The research groups I collaborate with use microscopy to understand composition and structure of materials. We will also need microscopy in the future as the research groups seek for better perovskite materials and thin film solar cells for harvesting energy from the Sun. It has already enabled the production of more stable perovskite solar cells that can replace the existing technology a lower cost. 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.

Q49.

4.2 Optional Document Attachment.

Note: Our strong preference is that answers are provided against the relevant questions in the survey. However, this file upload option is available for submissions in file format, where needed. Please ensure the document includes your name or organisation.