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

Microbes have the capacity to play a key role in the recovery of additional critical minerals from mine tailings while also reducing their toxicity. Additional research into their application for this purpose would be beneficial, particular given Australia's large mining industry. Such research would need to be underpinned by systems and synthetic biology efforts, detailed 'omics characterisation and novel machine-learning approaches to identify and potentially engineer critical proteins required for heavy metal sequestration. The design of suitable bioprocesses including bioreactor design and testing at a pilot-scale would then be required, with limited capability for this in Australia at the moment.

Q22.
Food and Beverage

Australia is perfectly positioned to contribute to the microbial production of food and beverages to supplement traditional sources, for example fish-meal replacement or synthetic milk, to meet the needs of a growing population while simultaneously reducing environmental and climate impact. Start-ups are emerging in this space and supported with initiatives such as FaBA, but scale-up capability is limited and potentially drives this industry overseas, representing a massive blow to our economy. Deeper investment into precision fermentation capability and developing systems biology and machine-learning approaches to help support the generation of high-performing strains will also help drive the development of this industry; data-driven rational design leveraging 'detailed strain phenotyping through 'omics analyses with metabolic modelling is likely a key approach to accelerate the industrial translation of these capabilities.

Q23.
Medical Products

The microbial production of medical compounds is a promising way forward when chemicals are too complex to be efficiently synthesised chemically, or are scarcely or non-sustainably sourced from nature. Again, investment into better rational design using metabolic modelling and machine-learning will accelerate this work, on top of additional fermentation capability.

Q24.
Defence

Q25.
Recycling and Clean Energy

It is difficult to deal with varied waste streams and many plastics can't be efficiently recycled. One catch-all method is waste gasification which can be used to feed one-carbon metabolising organisms such as acetogens, cyanobacteria or similar. Focussing synthetic biology efforts here, rather than distributed approaches to address individual waste streams such as agricultural waste, certain plastics, off-gas from mines or steel-mills etc can lead to a centralised effort to capture CO2 into commodity chemicals for a shorter-term impact, while establishing a robust recycling and waste management workflow which can also more readily be established at sources of waste, whether rural or urban.

Q26.
Space

Q27.
Environment and Climate

Similar to the recycling response above, carbon capture through microbial processes is a promising method to offset emissions while converting carbon into food or chemicals.

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

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Q33.

Protecting and restoring Australia's environment

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.

Substantial funding has been directed towards the establishment of 'omics analysis capabilities to underpin research and industry through BioPlatforms Australia. This is excellent, but the capability for these groups to utilise and learn from these datasets, especially from a systems biology, design-build-test-learn iterative design workflow, is underdeveloped. A deeper investment into developing data analysis and rational design capabilities that can enhance our ability to learn from these data sets, and guide rational design, would be transformative to the establishment of industry in Australia. Further investment into understanding how machine-learning can potentially enhance and improve are ability to learn from these datasets is also an area for promising additional development. Current strategies rely on investing in high-throughput strain building in the form of BioFoundries, but this remains somewhat time-intensive and expensive. The ability to have more hits on target with a data-driven approach underpinned by mechanisms such as metabolic-modelling should accelerate this approach, which needs to be complemented by sufficient fermentation capability. To retain industry, we also need to have additional fermentation capability, particularly at the pilot to large scale, as industry will otherwise be forced overseas to utilise systems there. Both of these requirements or capabilities underpin the majority of the key target areas identified by the NRI, and would accelerate the progression of each of these.

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.

Genome-sequencing, transcriptomics, proteomics and metabolomics analysis, fermentation capability and systems biology analysis; particularly through Q-MAP and IDEA-Bio for the majority of these.

Q39.

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

- [x] 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
- [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.