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

As stable isotope labelling gains prominence in pharmaceuticals and analytical chemistry for better performance, quantification, validation and tracing studies, emerging research directions are expanding beyond current capabilities. While Australia is uplifting its investment in drug development programs, diseases prevention and response preparedness, stable isotope labelling including deuteration infrastructure is not yet at a sufficient scale to support large-scale applications in the pharmaceuticals and healthcare space. Below are key research directions and the corresponding infrastructure gaps. • Advanced deuterated pharmaceuticals and personalized medicine for use in quantification, validation and tracing studies in preclinical and clinical settings. • Development of next-generation deuterated drugs with enhanced metabolic stability. • Deuterated biologics (e.g., monoclonal antibodies, peptides) for tracing as well as improved therapeutic effects. Infrastructure Gaps in Australia: • Deuterated compound synthesis facilities – Limited capacity for large-scale pharmaceutical-grade deuteration. • AI-Driven molecular design in chemical synthesis and labelling for increased efficiency, enhanced accuracy and resource optimisation. • Specialized pharmacokinetics and metabolic stability testing – Requires advanced isotopic analysis tools to study deuterium effects in vivo. • Deuterium-enriched GMP manufacturing – No large-scale good manufacturing practice (GMP) facilities for deuterated drug production. • Investment in sustainable heavy water (D2O) and D2 gas recycling/production technologies to reduce reliance on imports. International Benchmark: The U.S. has commercial deuterated drug development pipelines (e.g., Concert Pharmaceuticals acquired by Sun Pharma in 2023 and Retrotope). Poxel SA, a French clinical-stage biopharmaceutical company focused on therapies for rare metabolic diseases acquired a portfolio of deuterated drugs. - Siloed research institutions without open access model and science integration. The future of research is moving toward open access science, collaborative knowledge-sharing, and interdisciplinary approaches. Traditional, closed national research institutes that operate in isolation will struggle to remain relevant. This will be replaced by open-access research networks, global research consortia, and AI-driven knowledge-sharing platforms.

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

- Development of next-generation clean energy technologies, including not only advanced solar cells, hydrogen, and energy storage systems but also nuclear energy and development of small modular reactors. As such there is immediate need for preparing and developing the next generation of nuclear researchers and scientists. - Research into new materials for energy storage and energy-efficient construction - Advanced laboratories equipped with state-of-the-art instruments for materials characterisation, measurement and testing at the atomic scale. - Hydrogen production infrastructure via electrolysis of water. In addition to the production of hydrogen, this will enable the production of heavy water (D2O) as a side product which can be used in deuteration facilities and in the Australia's OPAL research reactor. No longer fit the definition: - large-scale infrastructure focused on coal, oil, and gas research may become less relevant in the long term.

Q31.

Supporting healthy and thriving communities

- Advancing precision medicine and personalised therapies is an important area. This requires sovereign capability in custom synthesis of isotopically labelled reference standards for accurate quantification and validation of preclinical and clinical studies. Drug development programs that do not obtain stable isotope-labelled internal standards (SIL-IS) for their bioanalytical methods, settle for using a surrogate internal standard (a compound that closely resembles the measured analyte) which can lead to unreliable data and be detrimental to a study. Therefore, there are scientific (matrix effect), regulatory (robust methods) and financial reasons (assay bias and timelines) that justify the investment of drug discovery programs and biotech pharmaceuticals in incorporating a SIL-IS for each measured analyte. - In the field of disease prevention and early detection, lipidomic biomarkers is gaining significant attention. Lipidomics holds great promise as a diagnostic tool for various diseases, ranging from cancer to metabolic disorders and neurodegenerative diseases. It enables the identification of disease-specific lipid biomarkers and provides valuable insights into disease mechanisms. However, due to the complexity and diversity of lipids in biological samples, accurate and reproducible lipidomic analysis requires the use of stable isotope and deuterated internal lipid standards. These standards are essential for quantification, normalization, and correcting for variations during the analytical process, thereby ensuring that lipidomic studies can provide reliable and clinically useful data. No longer fit the definition: Drug and therapies development programs that have reliance on overseas capabilities at any stage in their R&D to manufacturing pipeline (including clinical studies) will struggle in their responsiveness and sustainability during pandemics.

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.

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.

This question was not displayed to the respondent.

Q39.

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

This question was not displayed to the respondent.

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.