Can Australia emerge from the COVID-19 pandemic and build a world-leading RNA science-based biotech industry?

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Australia has led the world with several RNA research discoveries that have changed humans lives. Think: the discovery of the Shine-Dalgarno

sequence, enabling high yields of cloned medicines such as insulin and growth hormone, or CSIRO/Peter Waterhouse's RNAi technology to shut down or turn off genes to protect plants and animals from diseases.

But how are we positioned to continue with Australian-led innovations of RNA science? Think: personalized RNA medicine to treat cancer and neurodegenerative disease, or delivering RNA to plants to help them adapt to a changing climate.

Leading experts say Australia could deliver these innovations and become a world leader in RNA science and technology by establishing a national mission for the whole RNA science and technology pipeline in Australia, driven by strategic investment and prioritization across funding schemes.

They made the call on Thursday at a national roundtable hosted by the Australian Academy of Science and the Australia and New Zealand RNA Production Consortium.

The group, comprising 38 experts in RNA biology and biotechnology from the Australian university and research sectors along with industry, called on Australia to play a leading role in the global ecosystem of RNA science and harness the opportunities for Australian industry to develop RNA-based products and services for global markets.

The group also called for the establishment of a local mixed manufacturing ecosystem, including pilot facilities to enable new Australian products to be translated, production of pre-clinical trial components and a Good Manufacturing Practice (GMP) manufacturing capability to support clinical trials.

Co-Chair of the Academy-hosted national roundtable, Professor John Mattick from UNSW Sydney, said the considerable potential for RNA

based products had in many ways been overlooked up until now.

"However, the success of RNA based technology in the rapid development of safe and effective vaccines for COVID-19 has drawn sustained public interest in the technology," said Professor Mattick, who is also a Fellow of the Australian Academy of Science.

"With the first commercially approved mRNA-based vaccine products there is now considerable potential for the development of more advanced uses of RNA therapies and technologies, including the treatment of disorders such as arthritis, cancer and malaria and administering RNA to plants and animals to improve productivity and reduce environmental pressures.

"Australia has an opportunity to create an innovative RNA research and development 'ecosystem' and become a global player in this disruptive industry, creating and manufacturing high-value RNA-based products here, and exporting them to the world."

The expert group says Australia faces unique problems that stand to be solved by RNA science, including sensing new biosecurity threats and supporting climate change adaptation in agriculture. The expert group determined the following national research priorities, based on Australia's strengths and emerging global trends:

- RNA vaccines, including vaccines for people with autoimmune disorders
- RNA therapeutics
- RNA sensing tools
- The role of RNA in plant and animal development
- The role of RNA in brain function and disorders
- RNA chemistry
- Stability and advanced manufacturing of RNA therapeutics

- RNA delivery technologies

The rapid report from the roundtable and the list of participants involved is available here. Participation in the roundtable is not an endorsement of this rapid report.

What is RNA science?

RNA, or ribonucleic acid, plays a central role in the function of genes and the regulation of gene expression. RNA controls development in plants and animals, influencing areas as diverse as crop yields in agriculture, and brain function in humans.

RNA is one of the three major biological macromolecules essential for all known forms of life, along with DNA and proteins. For decades RNA has been viewed as the intermediate between gene and protein. It is now evident that many RNAs are not translated into proteins but rather act to control the complex processes of differentiation and development. These RNAs are also subject to modification, particularly in the brain, which connects hardwired genetic information to environmental parameters.

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