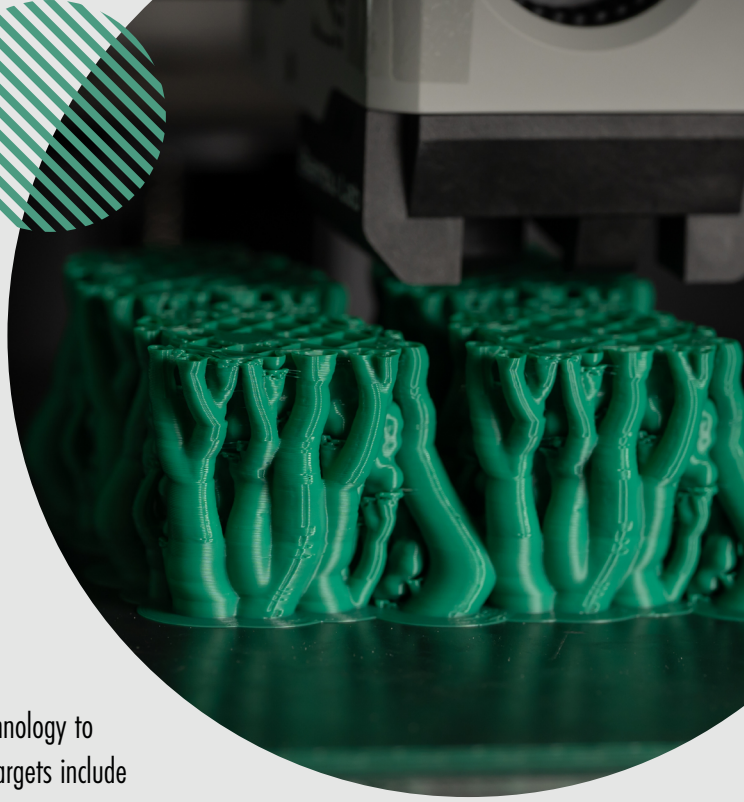
ARC CENTRE OF EXCELLENCE IN PLANTS FOR SPACE



BIOMANUFACTURING

The ARC Centre of Excellence in Plants for Space (P4S) is developing technologies to enable humans to survive and thrive in space, reducing the dependence on constant resupply, and using this lens to transform the sustainability of food and bioresource production on Earth.

One of our core missions is to develop pathways for on-demand bioresource production.

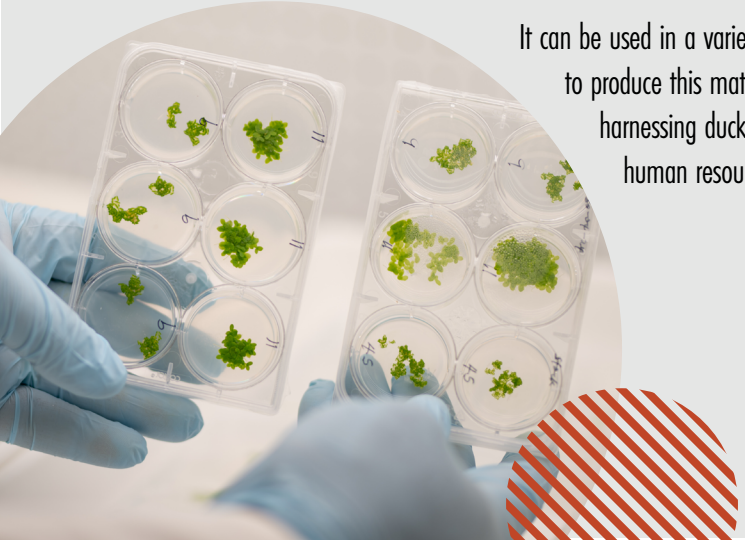
P4S will harness our team's deep knowledge of plant processes and genomic technology to create programmable, tuneable plant factories for bioresource production. Initial targets include flavours, pharmaceuticals, and polymer precursors for 3D printing, by creating:

- A library of plants and expression constructs for rapid, versatile, on-demand biomolecule synthesis. Each construct will drive expression of a single biomolecule, providing an à la carte menu of flavours, nutrients, or drugs that can be harvested within hours.
- A core collection of plants optimised for large-scale production of a staple biomolecule. These permanently modified plants can be transported as seeds and grown locally wherever a constant supply of biomolecule is required.
- *Smart Plants* already programmed to produce a broad range of required biomolecules, each of which can be triggered by a specific cue, e.g., light, nutrients; and
- *Sentinel Plants* with in-built biosensors for monitoring agricultural plant health and harvest readiness.

Importantly, P4S takes a system-wide approach to the sustainability of biomolecule production, extraction, and processing to ensure industry relevance. P4S will develop extraction and processing methods that consider small-scale (i.e., microfluidics) and novel purification (i.e., solvent-free extraction) options, as well as co-expression of plant enzymes to assist processing. Whole-of-system assessments of our plant and product innovations ensures that energy and mass flows meet sustainability and circularity targets.

CASE STUDY: BIOPRODUCTION OF POLYHYDROXYBUTYRATE (PHB)

PHB is one of the simplest and most commonly occurring polymers, with a projected market size of US$121M by 2028.
Traditional petrochemical plastics are based on a dwindling resource and are difficult to recycle in practice, resulting in non-recoverable waste streams and widespread contamination. PHB is a biodegradable bioplastic which may serve as a sustainable, drop-in alternative.



It can be used in a variety of applications, from food containers to absorbable sutures. However, the costs to produce this material using existing technology are a major hurdle. P4S is overcoming this by harnessing duckweed as a high-performance biomanufacturing platform, facilitating efficiency in human resource use here on Earth and beyond.

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ABOUT PLANTS FOR SPACE

The ARC Centre of Excellence in Plants for Space (P4S) is a transdisciplinary endeavour involving multiple skillsets from systems and process engineering, plant biology, food chemistry, psychology, education and space law. Our international and national consortium has representation across a wide range of industries. This includes space, controlled environment agriculture, and food manufacturing.

We will have a standing load of 200 Australian based researchers by 2026 located in our foundational universities of the Universities of Adelaide, Flinders, Melbourne, La Trobe and Western Australia, and aim to train over 400 researchers by 2031. We will encourage entrepreneurship, and a spin in and spin out culture, to support growth in the Australian space industry. We also have a large outreach program to schools and the general public, with all of our researchers spending at least 10 days per annum on engagement activities.

We provide a nucleus of activity, network and pathway to collaborative industry-academic partnerships globally to perform transformative research, develop plant and food technologies to enable long-term space habitation, and provide new sustainable high-value bioproduction on Earth. We are open to leveraging our skillbase to engage in new opportunities. Contact us for more information.

PLANTS FOR SPACE PARTNERS

Australian Universities
The University of Adelaide
The University of Western Australia
La Trobe University
The University of Melbourne
Flinders University

International Universities
University of California, Berkeley
University of California, Davis
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Space Lab
Gaia Project Australia

Government
South Australian Space Industry Centre (SASIC)
Defence Science and Technology Group (DSTG)
Department of Primary Industries and Regions, South Australia (PIRSA)

Space Agencies
National Aeronautics and Space Administration (NASA)
Australian Space Agency (ASA)
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Technology Providers
Twist Bioscience
BioPlatforms Australia
Australian Genome Research Facility (AGRF)
Australian Plant Phenomics Network (APPN)
National Imaging Facility (NIF)

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