**Print:**
**A5**
**Double Sided**
**Long Edge Binding**

# Do Not Print

Do Not Print

# STRAWBERRY

Strawberries' aroma, bright colour, juicy texture and sweetness make them highly appealing.

They can be a 'pick-and-eat' fruit or prepared with other foods or preserved. Their green leaves and stalks are also edible and rich in antioxidants.

Strawberry plants are compact and are well-suited to controlled environment cultivation

**LIGHT**

**WATER**

**GROWTH**

**YIELD**

- ⊕ Sweet fruit, vitamin C, appealing to the senses
- ⊖ Single-use plant, tasteless greens, seasonal fruiting

Bingx is investigating which variety of strawberries grow best in a vertical farms.

Using this knowledge, he looks for the specific genetic instructions that give each variety its desirable traits.

Once this genetic code is identified, it can be applied in synthetic biology.

Dive into the amazing world of researchers like Bingx and their groundbreaking work at www.plants4space.com.

PLANTS FOR SPACE
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# LEAFY GREENS

Leafy greens such as lettuce, spinach, kale and cabbage are excellent sources of vitamins, minerals and fibre.

They grow extremely quickly in controlled environments but require ample light and water.

These quick-growing, pick-and-eat plants are great in meals but spoil easily.

**LIGHT**

**WATER**

**GROWTH**

**YIELD**

- ⊕ Quick growing, pick and eat, high in vitamins and nutrients
- ⊖ Low in fat, low in carbohydrates, limited flavour

Marina is part of a team of researchers trying to figure out how to make plant-based cheese using water lettuce.

By blending up the plant and using some fun chemistry, the idea is that astronauts can make cheese from leafy greens since there are no cows on Mars!

Dive into the amazing world of researchers like Marina and their groundbreaking work at www.plants4space.com.

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# DUCKWEED

Duckweed is the smallest flowering plant and grows on the surface of fresh water. It can double in size within days and reproduce asexually.

The entire plant is edible and is rich in protein, starch, antioxidants, and vitamins. Duckweed could be valuable for water purification and bioremediation.

**LIGHT**

**WATER**

**GROWTH**

**YIELD**

- ⊕ High protein content, fast growing, cleans water
- ⊖ Limited flavour, low in fats

Many P4S scientists are investigate duckweed's potential as a key plant for use in space.

- Chigozie is looking into how duckweed protein can be extracted and used in new foods.
- Ryan is developing duckweed that produces abundant Vitamin A, C and D.
- Jonathan is engineering duckweed to produce bioplastic precursors.

Dive into the amazing world of space researchers and their groundbreaking work at www.plants4space.com.

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# TOMATO

Tomatoes are a staple food on Earth. Fresh or cooked tomatoes are great to eat and a source of vitamins and antioxidants.

Tomatoes have a high concentration of specialised leaf hair cells that could release potentially useful bioactive chemicals.

**LIGHT**

**WATER**

**GROWTH**

**YIELD**

- ⊕ High in nutrients, enjoyable fruit
- ⊖ Large plant, leaves and vine not of use

Thomas and Lee are studying how specialised defence cells found on leaves and flowers of plants called trichomes could be used to make medicines. Tomato plants have a lot of trichomes that could be used as bio-factories to produce medicine.

Lee is looking into the genetic pathways of compounds produced in Trichome. Thomas is researching the genetic pathways that determine the type of trichome plants grow.

Dive into the amazing world of researchers like Thomas and Lee and their groundbreaking work at www.plants4space.com.

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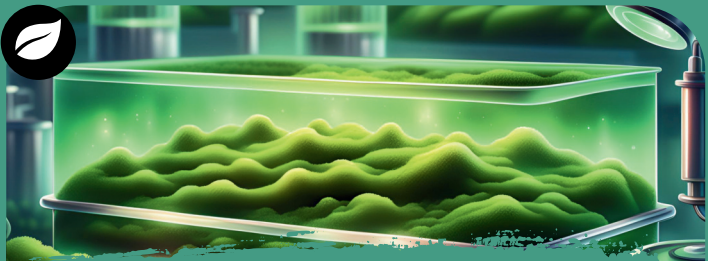

# MOSS

Moss is very low-maintenance, needing minimal light and nutrients. It can survive in extreme environments.
Many mosses can dry out and revive when water becomes available.
Moss isn't very tasty. But its simple genetic makeup makes it great to modify to make it into a bio-factory to produce useful chemicals.

**LIGHT**

**WATER**

**GROWTH**

**YIELD**

- ⊕ Easy to grow, simple genetics, potential bio-factory
- ⊖ Poor taste, low biomass

James, Meggie and Florence are part of a researcher team working with to make novel food, medicines and materials using moss.

Moss has a unique genetic structure making it a prime candidate for genetic modification. Using synthetic biology, this team will modify moss so that it produces protein-based medicines for medical conditions related to deep space exploration.

Dive into the amazing world of researchers like James, Meggie and Florence and their groundbreaking work at www.plants4space.com.

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# WILD CARD

From towering trees to tiny herbs, plants are wildly different, and they produce an amazing array of useful goodies.

Picture combining all the best traits from these "all-stars" plants to create the ultimate plant.

Why settle for just one when we can mix and match nature's finest to grow something epic?

LIGHT ?

WATER ?

GROWTH ?

YIELD ?

Future experts in plant biology, psychology, artificial intelligence, nutrition and technology are essential for developing the foods and plants required for long-term space and off-Earth habitation.

These skills will also help humanity live more sustainably on Earth. If we can grow plants in space, we can grow them anywhere on Earth!

Dive into the amazing world of the many researchers and their groundbreaking work at www.plants4space.com.

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# SUPER FRUITS

Transporting fresh fruit to space is difficult, but cultivating fast-growing, nutrient-dense fruit in space habitats could change everything!

Space-ready fruits must be easy to grow, highly nutritious, and adaptable to small growing spaces.

Michelle wants to create the perfect space plant! This new plant should provide nutrients and calories for humans, cheer people up and clean the water and air.

Michelle has chosen to engineer strawberry plants for extraterrestrial cultivation.
She is harnessing the powers of natural and synthetic biology to make strawberries the ultimate space plant – bursting with extra flavour, fragrance and nutrients, optimised for confined spaces with increased yield, and a joy-to be around!

Dive into the amazing world of researchers like Michelle and their groundbreaking work at www.plants4space.com.

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# ZERO WASTE

All parts of a zero-waste plant will be utilized for a variety of products and purposes.

Everything from the flowers, stems, leaves and even the roots will play a part in allowing astronauts to thrive in space.

Kim's research is looking at how plants sense their environment, grow, develop, look the way they do, and their chemical composition.

She's researching the effect of touch has on plant growth, what they look like, how tall they grow and if this would help space and vertical farming.

Dive into the amazing world of researchers like Kim and their groundbreaking work at www.plants4space.com.

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# MATERIALS

On Earth the materials that plants are made of are used to make many things like clothing, building materials, paper, tools and many other items needed to survive.

Plants grown in space will be needed to make traditional materials, but also new sustainable materials like bioplastics for 3D Printing.

Jen is transforming plants into bio-factories using synthetic biology to address challenges in space and on Earth.

She creates duckweed with vitamin D for plant-based diets, and engineers plants to produce biodegradable bioplastic PHB.

Through these innovations, plants become powerful allies in shaping a sustainable future for humanity.

Dive into the amazing world of researchers like Jen and their groundbreaking work at www.plants4space.com.

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# MEDICINE

There’s no pharmacy on Mars!

Instead of pills, medicinal plants could provide treatments for headaches, stomach issues, or even serious illnesses.

Plants could have a library of medicines they could possibly produce embedded in their DNA.

Ryan is investigating how to hack plants' metabolism and encourage them to make useful products like medicine.

He is using synthetic biology, adding new genes into plants to create new chemical pathways to make vitamins and medicines they could not make before.

This is super useful for astronauts in space, and for people on Earth too.

Dive into the amazing world of researchers like Ryan and their groundbreaking work at www.plants4space.com.

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# FUTURE FOODS

From plant-based meat alternatives to 3D-printed meals, future foods will revolutionise how astronauts eat.

Scientists are exploring ways to use plant compounds to improve taste, texture, and storage.

Sally is on a quest to find the perfect way to process plants into tasty plant-based future foods.
Sally's experimenting with different ingredients to achieve the perfect texture and flavour. She is rearranging the chemical make-up of foods and evaluating possible new food plants. And she's making sure her methods are energy and water-efficient while keeping the food delicious and nutritious.
The results of her experiments may end up on your plate!

Dive into the amazing world of researchers like Sally and their groundbreaking work at www.plants4space.com.

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# COMPLETE NUTRITION

A fully plant-based diet could be tailored to deliver all essential nutrients needed to survive.

The challenge lies in ensuring that just a few plant species can provide the full range of nutrients that we currently obtain from a diverse mix of plant and animal sources.

Another challenge is making them look, taste and feel great!

Harvey loves how plants make proteins. He knows that individual plants don't make all the proteins humans need to survive.

He is tinkering with the genetic composition of plants to ensure they contain an abundance of essential amino acids that humans need to survive.

By doing so, he's transforming ordinary salad vegetables into hearty and fulfilling meals that pack a nutritional punch.

Dive into the amazing world of researchers like Harvey and their groundbreaking work at www.plants4space.com.

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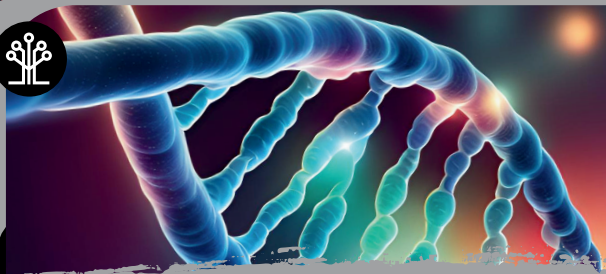

# SYNTHETIC BIOLOGY

Synthetic biology allows scientists to modify plants with precision.

Unlike traditional genetic engineering, which transfers single genes, synthetic biology designs entire genetic circuits.

This technology can improve crop yield, nutrition, stress resistance and medicinal production. These circuits can be switched on and off, giving plants multiple functions.

Christine investigates human digestion and is looking into possible future foods and synthetic bio-products using a synthetic lab-based digestive system.

She is helping to create super-nutritious foods that are easy to digest! Her work could revolutionise diets for people with digestion issues on Earth and ensure astronauts get essential nutrients in space.

Dive into the amazing world of researchers like Christine and their groundbreaking work at www.plants4space.com.

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# SWITCHES

Using synthetic biology, plants can be programmed to produce specific biomolecules in response to triggers such as light, heat or nutrients.

When exposed to these triggers, the plant reacts within minutes and initiates the programmed biological process.

This process could be as simple as a colour change or the production of specific biomolecules.

Amy is developing ways for chloroplasts to make designer proteins in plants.

Using light as a genetic switch, she can turn on the production of certain proteins, like hormones that promote bone growth.

Her work focuses on making useful proteins - on demand - only when they are needed, creating ‘smart’ plants that function as efficient bio-factories.

Dive into the amazing world of researchers like Amy and their groundbreaking work at www.plants4space.com.

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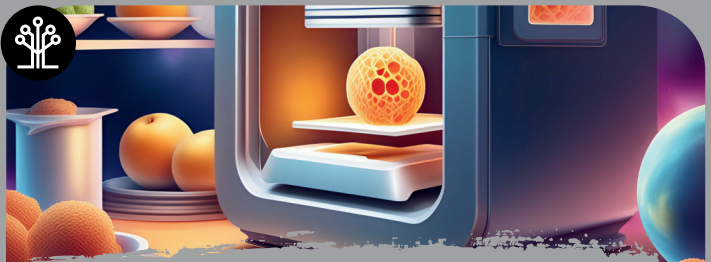

# 3-D PRINTING

With the right feedstock, 3-D printers can create just about anything - tools and parts, houses and even food!

Imagine using raw materials found or grown in space to feed into these printers, helping humans not just survive, but thrive in the vastness of space.

No need for warehouses packed with extra supplies if we can 3-D print what we need on demand - we'll be ready for anything, anytime.

Lydia is exploring how to create nutritious and textured foods that can be stored long-term.

She's made crispy duckweed nori, pickled duckweed, and a duckweed smoothie, with hopes of developing it into a yoghurt.

Using 3-D printing, she envisions transforming duckweed into beautiful shapes or cubes for efficient storage, making her a pioneer in future healthy foods.

Dive into the amazing world of researchers like Lydia and their groundbreaking work at www.plants4space.com.

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# AUTOMATION

Astronauts will have many jobs to do while living on the Moon and Mars, and time will be limited.

Robots will help ease the workload of astronauts by performing many tasks. Agribots will care for and harvest plant material for food and resources.

Automatic processing of plants into usable products is also an important goal of Plants for Space.

Ali is studying how plant movement can show how healthy plants are. By recording natural plant movements throughout the day, Ali is training A.I. to recognise when a plant is stressed and needs attention.

This tool could be used by agribots to care for individual plants or enable plants to act as biosensors, alerting astronauts to poor environmental conditions.

Dive into the amazing world of researchers like Ali and their groundbreaking work at www.plants4space.com.

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# VERTICAL GARDENS

Space is vast, but growing areas are limited inside spacecraft and space habitats.

Vertical gardens stack plants like bookshelves, maximising space for food production.

To make vertical farms efficient, low-energy lighting systems, specialised growth mediums and hydroponic life support systems will need to be designed for off-Earth environments.

Mat is strengthening plant ability to withstand extreme environmental conditions.

His research has led to the development of salt-tolerant and drought-resistant crops.

Now, he is applying this expertise to optimise plant growth in recycled water- an essential innovation for vertical farming, where maximising yields with minimal water and nutrients is critical.

Dive into the amazing world of researchers like Mattand their groundbreaking work at www.plants4space.com.

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# A.I. / IMAGING

A.I. and computer vision technology are transforming plant care on Earth and in space.

A.I. can monitor plant health, detect diseases, and even decide when food is ready for harvest. A.I. can look for small details and patterns that people might miss.

It can also track human biometrics for astronaut wellbeing.

Sigfredo is using cameras and A.I. to learn more about people's food preferences using the human facial expressions.

Menu fatigue and foods tasting different in space are a real problem for astronauts, and this work will help develop interesting and enjoyable foods for space (and Earth).

Dive into the amazing world of researchers like Sigfredo and their groundbreaking work at www.plants4space.com.

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# MENTAL HEALTH

Being an astronaut is hard work and takes a toll on the mind. A healthy mind is needed so far from home. And there are so many things to do and concentrate on.

The exercises we do, the foods we eat, and the experiences we have affect our mental health in many ways.

Eva is a psychologist and is finding out how people feel about future foods and if they would be happy to eat them.

She's asking people's opinions on eating things like spinach space cheese, duckweed chips, nutrient smoothies and why they like certain foods. Future foods will only work if people like to eat them.

Dive into the amazing world of researchers like Eva and their groundbreaking work at www.plants4space.com.

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# PHYSICAL HEALTH

Away from Earth, the human body needs special attention to keep up with all the demands of being an astronaut.

Taking care of their bodies and their physical health is part of the daily job an astronaut is required to do, and diet is key to this.

Ian is working out the best ways to develop plants that make useful products that we will need in Space.

Plant leaves contain green compartments (chloroplasts) that make sugar by photosynthesis. Ian's idea is to re-program chloroplasts to make other useful molecules such as nutrients to improve food or medicines to prevent or cure diseases in Space.

Dive into the amazing world of researchers like Ian and their groundbreaking work at www.plants4space.com.

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# SOCIAL WELLBEING

People gathering around campfires, baking biscuits, playing cricket or strolling through the garden are all examples of how plants can bring people together and enjoy life.

Plants can give people activities, joy, meaning to their lives, and stories to share,
These things will help humans not just survive but truly thrive beyond Earth!

Melissa is a space lawyer. She is writing the rules to make a safe and ethical space society for people to live and work in.

As space, the Moon and Mars become bustling hubs of activity, it is crucial to establish guidelines and rules for working and living in these unique environments.

Dive into the amazing world of researchers like Michelle and their groundbreaking work at www.plants4space.com.

PLANTS FOR SPACE
ARC CENTRE OF EXCELLENCE

# MATERIALS

Plants aren't just for food on Earth – they're used to make many things like clothing, building materials, paper and tools.

The plants heading to space will need to do the same, while also providing nutritious food.

Volker's specialty lies in transforming industrial processes to make them more sustainable.

Additionally, he possesses expertise in simulating space and moon conditions on Earth to enable researchers to investigate how these environments affect plants and materials.

Dive into the amazing world of researchers like Volker and their groundbreaking work at www.plants4space.com.

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