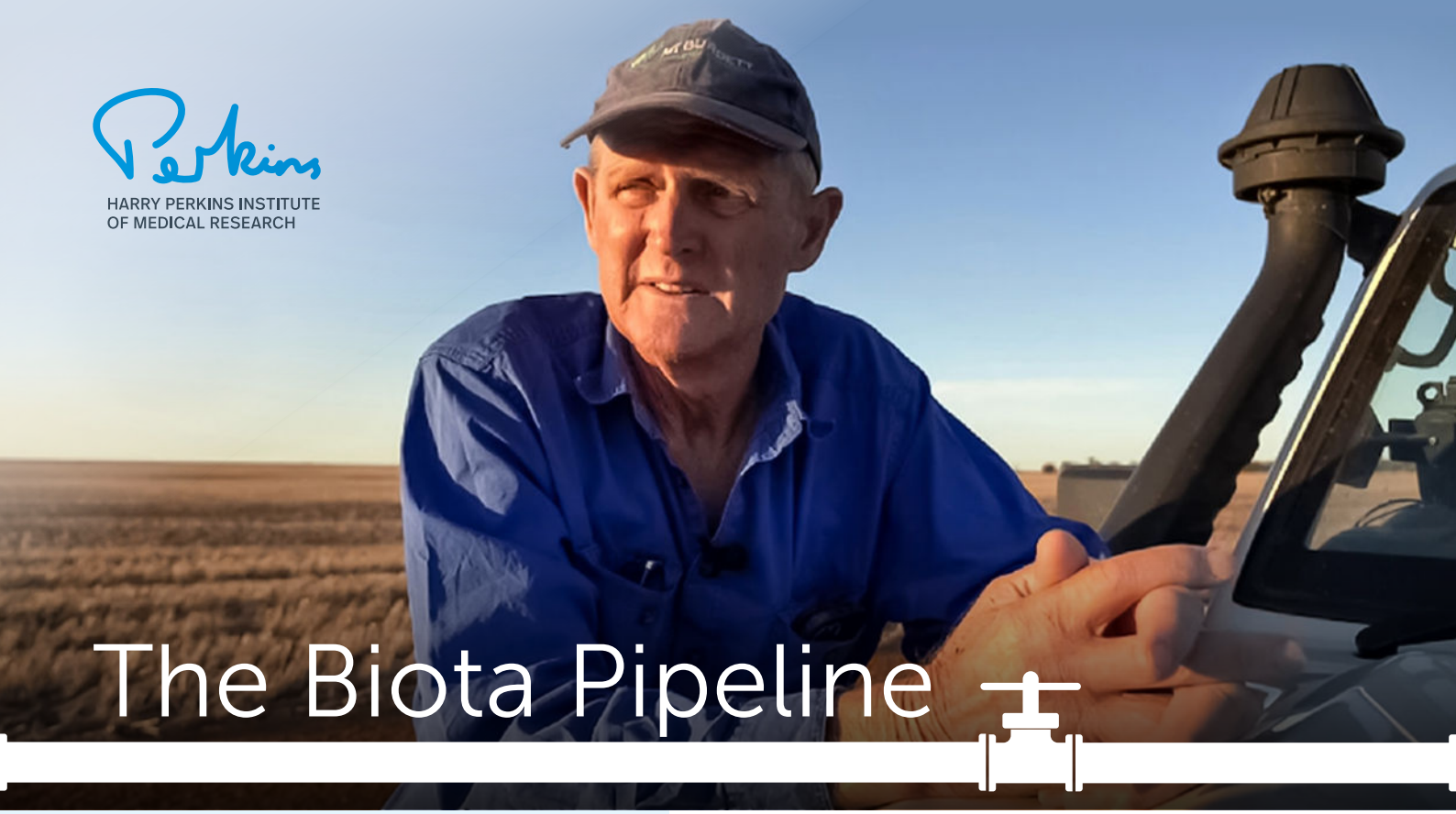
HARRY PERKINS INSTITUTE
OF MEDICAL RESEARCH



The Biota Pipeline

Image credit: ABC - Mark Bennett

Director's Message

The Biota Project was born from one man's love of nature as a resource, comfort and most importantly healer.

Chris Reichstein did not live to see his legacy come to life, but you can help make that happen – in his honour.

It might surprise you to learn that our namesake Harry Perkins AO started his life as a farmer in Bruce Rock. Today his signature adorns WA's leading medical research centre which is home to more than 250 experts focused on beating the world's toughest cancers and cardiovascular diseases. It is to Harry's community-spirit, dedication and generosity, that we owe our present-day success, and in the short time I spent with Chris I saw that he too shared the same exceptional values.

The natural world has been a rich source of medicines for thousands of years. WA has one of only two Global Biodiversity Hotspots in the country – containing the highest concentration of rare and endangered species. Many of which have been known to have medicinal properties.

This untapped resource of potentially life-saving treatments is of keen interest to researchers around the world. But none have the advantage of having such a rich supply of potential new cures in their own backyard.

The Perkins has the expertise and talent to bring Chris' vision to life, but we need your help to build a robust pipeline to push potential new treatments from discovery through to clinical trials to finally being made available to you and your loved ones – if and when you need them.

Chris's vision was to push medical research forward through the power of the natural world. He loved the land and understood its deep ability to provide so much to so many. Through his Mount Burdett Foundation, he left a legacy gift to establish the Biota Project. Your help is needed to bring this vision to life.

Warm regards

Professor Peter Leedman AO
Director, Researcher, Doctor, Donor

Biota Pipeline

You have the opportunity to collaborate with expert scientists to develop Western Australia's first specialty pipeline that is purpose built to test biota (organisms) for their anti-disease properties and support discoveries from lab bench to patient bedside.

Here is a simplified overview of the typical steps involved:

IDENTIFICATION & COLLECTION

Scientists collect samples of biota, such as plants, marine organisms, or microorganisms, which are known to have the potential for producing bioactive compounds.

EXTRACTION & ISOLATION

The collected samples undergo extraction processes to obtain crude extracts. These extracts are then subjected to isolation techniques to isolate individual compounds or groups of compounds.

SCREENING

The isolated compounds are screened against various biological targets or disease models to evaluate their potential anti-disease properties.

ASSAY DEVELOPMENT

Scientists develop specific assays to measure the activity of the compounds against the chosen target or disease.

HIT VALIDATION

Compounds showing promising activity in the initial screening are further validated to ensure the observed effects are reproducible and not due to artifacts or false positives.

OPTIMISATION

The validated compounds undergo further modifications and optimisation to enhance their potency, selectivity, and pharmacokinetic properties.

PRE-CLINICAL TESTING

The optimised compounds undergo rigorous preclinical testing, including in vitro experiments and animal studies, to evaluate their safety, efficacy, and potenial side effects. This phase helps determine if the compound has the potential to be developed into a drug.

CLINICAL TRIALS

If a compound successfully passes the preclinical stage, it progresses to clinical trials. These trials involve testing the compound on human subjects in a carefully controlled manner to assess its safety, dosage, effectiveness, and potenial adverse reactions. Clinical trials typically have multiple phases, starting from small-scale studies with healthy volunteers to large-scale trials involving patients.

REGULATORY APPROVAL

After successful completion of clinical trials, the compound can be submitted for regulatory approval to the relevant authorities.

COMMERCIALISATION & POST-MARKET SURVEILLANCE

Once regulatory approval is obtained, the compound can be manufactured, marketed, and made available for patient use. Post-market surveillance involves ongoing monitoring of the drug's safety and effectiveness in real-world settings.

WA's South West Ecoregion

Stretching from Shark Bay to Esperance, the South West Australia Ecoregion (SWAE) is one of Australia's two Global Biodiversity Hotspots. Home to a variety of unique flora and fauna – many of which are under serious threat – this region has the highest concentration of rare and endangered species in Australia. Although it only covers 5% of the Australian land mass, SWAE contains about 8,000 plant species – more than one-third of Australia's known flowering plants.

75% of the plants discovered so far are endemic to WA. It is also home to many different animals, birds and fungi species, many of which also cannot be found anywhere else (7 species of mammals, 13 species of birds, 34 species of reptiles and 28 species of frogs).

Examples of medicines discovered in nature:

1. **Taxol,** an anti-cancer drug derived from the Pacific Yew tree
2. **Aspirin,** which comes from the bark of willow trees
3. **Morphine,** a pain killer extracted from the seed pods of poppy plants
4. **Erythromycin,** an antibiotic derived from a soil living organism
5. **Tamoxifen,** a breast cancer drug made from a woody evergreen shrub

Project A

SEA SPONGE

HARRY PERKINS INSTITUTE OF MEDICAL RESEARCH

LABORATORY:	UWA, Natural Products and Chemical Ecology
LEAD RESEARCHER:	Dr Gavin Flematti
DISEASE TARGET:	Cancer
PIPELINE STAGE:	Assay Development
REGIONAL COMMUNITY BENEFIT:	South Western Australia

BACKGROUND

Associate Professor Gavin Flematti is a distinguished researcher and academic at the University of Western Australia (UWA) who has made significant contributions to the field of natural product chemistry and drug discovery. His work focuses on the exploration of marine microorganisms and plants to identify bioactive compounds with potential applications in medicine, agriculture, and environmental protection.

A/Prof Flematti has made significant strides in investigating marine microorganisms from WA's Southwest region, particularly their production of natural products with therapeutic potential.

OVERVIEW

One of A/Prof Flematti's key research interests is identifying and characterizing the unique chemical compounds present in sea sponges. Dr Flematti has a particular interest in the sponges found under the Busselton Jetty, which are believed to be one of 300 species in the area, some with unique properties due to the shade, shelter and Leeuwin current.

Sea sponges are known to produce a wide array of bioactive molecules, including alkaloids, terpenes, peptides, and polyketides. Through extensive sampling and analysis, Professor Flematti has discovered novel compounds from various species of sea sponges, unveiling their potential applications in medicine and other industries.

These bioactive compounds derived from sea sponges have demonstrated remarkable properties with implications for drug discovery. Many of them exhibit significant anti-inflammatory, antiviral, and anticancer activities. By isolating and studying these compounds, Professor Flematti aims to better understand their mechanisms of action and potential therapeutic uses.

Furthermore, A/Prof Flematti's research on sea sponges includes investigating their ecological roles and interactions within marine ecosystems. Sea sponges are critical components of reef systems and play important roles in nutrient cycling and habitat provision. By studying their ecological functions, Professor Flematti contributes to our understanding of the intricate relationships between marine organisms and their environments.

POTENTIAL

The Biota Pipeline has the potential to advance Dr Flematti's work and open up new avenues for drug discovery and the development of innovative therapies. Additionally, his contributions to understanding the ecological roles of sea sponges contribute to the broader field of marine biology and conservation.

Project B

BEE VENOM FOR BREAST CANCER

HARRY PERKINS INSTITUTE OF MEDICAL RESEARCH

LABORATORY:	Cancer Epigenetics
LEAD RESEARCHER:	Dr. Edina Wang
DISEASE TARGET:	Breast Cancer
PIPELINE STAGE:	Optimisation

BACKGROUND

One of the key areas of research at the Perkins that could benefit from the Biota Pipeline is that of Dr Edwina Wang who is working within the Cancer Epigenetics lab under the supervision of Associate Professor Pilar Blancafort to investigate the use of melittin, a compound found in bee venom, to kill cancer cells.

Using the venom from 312 honeybees and bumblebees in Perth Western Australia, Ireland and England, Perkins researchers tested the effect of the venom on the clinical subtypes of breast cancer, including triple-negative breast cancer, which has limited treatment options. The initial discovery was published in esteemed journal *Nature Precision Oncology* in early 2020 and garnered global media attention.

Melittin is the peptide found in bee venom that has been shown to have anti-cancer properties that has now been synthesised. It works by disrupting the cell membrane of cancer cells, causing them to rupture and die, while leaving healthy cells unharmed.

OVERVIEW

The research is still in the pre-clinical stages, but the initial results are promising. In laboratory tests, melittin has been shown to kill a wide range of cancer cells including breast, prostate, and melanoma. It has potential to be the first effective treatment for the notoriously hard-to-treat triple negative breast cancer, that effects 10-15% of all breast cancer patients and has a poor prognosis.

Dr Wang is continuing to work on determining the safety and effectiveness of melittin as a cancer treatment. She will test different formulations of melittin to find the most effective way to deliver the compound to cancer cells, whilst also exploring the use of melittin in combination with other cancer treatments to enhance their effectiveness.

Additionally, because melittin specifically targets cancer cells, it may have fewer side effects than traditional cancer treatments such as chemotherapy.

POTENTIAL

The journey of this project from lab bench to patient bedside would be supported by the Biota pipeline.

The initial results are promising and could lead to new, more effective treatments for cancer patients in the future. The purpose-built specialty pipeline could support Dr Wang with access to the latest technology, skilled experts and trusted guidance to take this natural compound, through the process of drug development, and to the people who need it most.

Project C

SHARK BAY SEA CUCUMBERS

HARRY PERKINS INSTITUTE OF MEDICAL RESEARCH

LABORATORY:	Molecular Endocrinology and Pharmacology
LEAD RESEARCHER:	Professor Kevin Pfleger
DISEASE TARGET:	Cancer
PIPELINE STAGE:	Identification and Collection
REGIONAL COMMUNITY BENEFIT:	Shark Bay

BACKGROUND

The Biota Pipeline holds potential to drive early discoveries through a specialty research pipeline. A project that could benefit from this initiative is a large collaborative effort, spearheaded by Perkins Professor Kevin Pfleger and Tidal Moon founder, Michael Weir.

Tidal Moon works in collaboration with three Aboriginal communities: Mulgana (Shark Bay), Bayungu (Coral Bay/Exmouth) and Thalanyji (Onslow). Their goal is to preserve and enhance the economic viability of the commercial fisheries within the traditional language group boundaries, while also enabling sea grass restoration and bioprospecting.

Michael is a leader in the Indigenous Aquaculture Industry and leads a crew of divers in Shark Bay. The team are working collaboratively with the Perkins to establish world class Biotechnology Research into North West WA sea cucumber species.

They aim to integrate aquaculture with the search for novel active compounds that may form the basis for new dug development, thereby establishing a unique WA biotechnology.

OVERVIEW

Tidal Moon plans to study wild and farmed WA sea cucumber populations for pharmaceutical development.

Sea cucumbers are marine animals that are known for their distinctive appearance and their importance in traditional Chinese medicine. Recent studies (mainly US) have revealed that sea cucumber venom is made up of various compounds that have been found to have anti-cancer properties and unlike conventional cancer treatments, which can have a range of toxic effects on healthy cells, is selective in its toxicity. This means that it maybe able to target cancer cells without harming healthy cells.

The Biota Pipeline can support this promising research project here in Western Australia as Tidal Moon partners with Perkins expert scientists to explore the unique compounds found within Shark Bay sea cucumber species.

POTENTIAL

The Biota pipeline will provide an expert-resourced specialist path for a potential drug discovery to move through the necessary stages and reach cancer patients sooner. It will also provide far-reaching community benefits beyond the potential pharmaceutical discoveries by ensuring the regional indigenous teams are provided with economic, employment and educational opportunities throughout the process.

Project D

AGRICULTURE IN SPACE

HARRY PERKINS INSTITUTE OF MEDICAL RESEARCH

LABORATORY:	Epigenetics and Genomics
LEAD RESEARCHER:	Professor Ryan Lister
DISEASE TARGET:	All
PIPELINE STAGE:	Identification and Collection

BACKGROUND

Professor Ryan Lister, from the Harry Perkins Institute, has been involved in ground-breaking research on genetic editing to enhance the design of plants. By manipulating complex control programs within organisms, he aims to create plants with improved and novel productivity that can respond to specific environmental factors with precision. This level of genetic manipulation can optimise plant productivity and nutrition, improve their ability to withstand climate change and pests, and even create high-value molecules efficiently.

In addition to its applications here on Earth, this research has the potential to revolutionise space agriculture. Prof Lister is part of a special team of three esteemed scientists from UWA's School of Molecular Sciences, who have all received the WA Scientist of the Year Award. The primary objective of their 'Plants for Space' research centre is to support the establishment of a long-term human presence in space, while providing parallel improvements to Earth-based agriculture.

OVERVIEW

By developing innovative plant varieties and production systems, the centre aims to provide space explorers with more nutritious food and on-demand production of medicines and materials without the need for resupply missions from Earth. Plants, being solar-powered biofactories, have the potential to meet the nutritional and health needs of astronauts while also serving as a source for useful molecules and materials.

The team will focus on the cultivation of pick-and-eat plants such as water spinach, tomatoes, and strawberries for immediate consumption. Additionally, they will explore the use of duckweeds, which are fast-growing plants, to develop food plants for long-term space nutrition, and programmable biological factories to produce required medicines and materials on demand. These efforts will contribute to establishing sustainable food production systems during space missions.

By understanding natural genetic control programs, scientists can engineer plants that are better suited to withstand changing climate patterns and environmental stresses. This advancement can play a vital role in climate-proofing agriculture and ensuring food security here on Earth too.

POTENTIAL

While the vision of growing genetically engineered plants on Mars is still a distant goal, the research conducted by Prof Lister and his colleagues paves the way for future advancements.

How **you can back the Biota pipeline** to beat the world's toughest disease

You can help bring this vision to life by supporting the establishment of the Biota Pipeline with a tax-deductible gift to fund the brightest minds working on the hardest to treat diseases backed by the power of nature.

This pipeline will be established in Chris's honour as a lasting legacy with the potential to discover treatments that will change medicine forever.

For more information on how you can support this important project, please contact:

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