DASEIN.

Metaphor.

EXECUTIVE SUMMARY

Welcome to Dasein's concept Metaphor.

Through being a part of Design Factory Melbourne, our small team, Dasein, was given the opportunity to look into solving a sustainability issue in their local context, Australia. They would be working inline with the United Nations Sustainability goals. More specifically, sustainability goal 12: Responsible production and consumption and with this problem space is where their issue would derive from. Dasein would also be working alongside CERN ideasquare where they would travel to CERN for two weeks and gain a coach throughout their project that would aid them in utlising the appropriate CERN technologies into their final outcome. Dasein's solution has to be appropriate for the year 2030 with the consideration of its implementation in the years 2020 and 2025 leading up to it.

Dasein targeted the United nations sustainability goal 12 of responsible production and consumption through food wastage in a public hospital environment as it is an ever prominent sustainability issue in Australia. Through our research into food and hospital waste in hospitals it was clear that this area is an immediate issue that needs to be addressed.

What Dasein proposes as a radical conceptual solution for the year 2030 is the elimination of food wastage in hospitals entirely. This will eliminate the amount of waste hospitals are placing into our landfills and a more effective and efficient way to feed the patients, mitigating malnourishment in hospitals.

Our Solution consists of a holistic system that caters for both those that can orally consume food, and for those that cannot.

As this solution is designed with the year 2030 in mind, obviously we assume that with the current trends of technology today, 2018, these solutions could be probable. The ultimate goal of our research and outcomes are to inspire the growth in importance of sustainable practices and living with a new and fresh perspective that could motivate change.

This is our solution, Metaphor.

Paris Triantis **Justin Yuan** **Lachlan Mackay**

OUR TEAM

This is Dasein. We consist of three designers, an interior architect and two industrial designers. The reason we have called ourselves Dasein is that in German, Dasein encapsulates the meaning of being and being present which Martin Heidegger, a late German philosopher then redefined the term to mean "Preparing for the immediate world in which one lives but also understanding each individuals decisions and the ramifications that has on our natural, economical and social world".

This is something as a team we have held close to our hearts having undertaken such an important project.

Lachlan Mackay

Lachlan is an Industrial designer currently completing his honours year at Design Factory Melbourne, participating in the challenge based innovation project (CBI). Lachlan's main role in the team was to organise and represent Dasein's concept Metaphor, graphically and narratively, whilst also assisting with CAD. Ths has come through the way of creating videos, designing products, model making and building physcial touchpoints that will immerse those interested in Metaphor. Lachlan's interests have been in working towards producing an interesting wireframe for both Metaphor as a holistic system including two important solutions, Metaflora and Metaphora. We are very passionate about our concept with our goal being to just spread awareness on the possibilities of the future head, between hospitals and CERN technologies

Paris Triantis

Paris is an Interior Architecture Honours student from Swinburne University of Technology. She is currently completing her honours with Design Factory Melbourne in the CBI A3 project, Challenge Based Innovation focussing on CERN's technologies and the Sustainable Development Goals set by the United Nations. Paris' major role in the team was focussing on researching CERN's technology, nanotechnology, transdermal patch research and architectural model making and rendering. Paris produced two final architectural models, which focused on the Metaflora concept. Paris' interest has been geared mostly towards CERN technologies, transdermal technologies, nanotechnologies and looking into the finer details to make sure concepts work. We can see our systems and designs concepts eventually being adopted and adapted by other companies in order to reduce Australia's contribution to Food Waste.

Justin Yuan

Justin is an Industrial Design Honour student from Swinburne University of Technology. Completing his honours with Design Factory Melbourne and his involvement in the challenge based innovation project, known as "CBI". His major role has been to assist and support his fellow teammates by ideating, producing quick mockup prototypes, digital graphics and final concept models. His interest within this project has been more oriented towards learning and improving skill sets, pushing boundaries of innovation and gain insight in other diverse disciplines. Justin believes that this concept has opened the door for new possibilities and opportunities to resolving the challenges of food waste. This concept is a long term goal, as nothing can truly be resolved. However it can be a stepping stone to setting an example for change.

PROBLEM

Trends that arose through Dasein's research of sustainability issues in Australia lead us in the direction of food waste in public hospitals. Four key themes that made this problem so prevalent for our scenario of developing solutions for the year 2030 were; That we are a forever growing and ageing population, Australia's trending behaviour of extremely poor food wasting habits, the attitudes that hospitals have towards waste in general and that in 2030, due to climate change, the effects water scarcity and soil erosion on our agricultural lands that are meant to be feeding people in the future.

With Hospitals today, it is understandably very difficult to mitigate waste production in their current environment given the extremely strict legalities in place to try and keep all those in and passing through a hospital as sterile as possible. Under the current situation much of hospitals waste is thrown away as soon as it has been opened or interacted with its environment. Patients in hospitals today, once they have received a meal, are to eat said meal, in the instance they do not feel the desire to eat, this meal gets returned to the kitchen where it is discarded and ends up in our landfill sites. The desire to eat in such a turbulent environment also plays a large factor on whether the meals prepared are actually consumed. Patients may have a loss of appetite, been requested to fast, been given an incorrect meal or not finish their meals for various reasons, most in which is due to the actual quality of what the average hospital may be serving in general.

If in any case there is a possibility to utilise the waste and stop it from being placed in the ground, we would then be able to use this waste as energy sources but also for other purposes that will aid the fight against waste and the rise in demand of renewable and clean energy sources along with maximising our consumption of food to production.

FRUIT AND VEGETABLE

The most commonly thrown out food is fruit and vegetables, followed by uneaten take-away food, meat and fish.

25x MORE

Food Wise says when food waste rots in landfill it produces methane, a greenhouse gas 25 times more potent than the carbon pollution that comes from a car's exhaust.

$1050 PER HOUSEHOLD ANNUALLY

On average all Australian households throw out about 14 per cent of the food they buy, effectively each wasting $1050 annually.

1.3 BILLION TONNES

One third of all food produced is lost or wasted – around 1.3 billion tonnes of food – costing the global economy close to $940 billion each year

METAFLORA

THE FUTURE IS HOSPITAL FARMS

		2020	2025	2030
FOOD WASTE	Data Collection over 10 years			
	Beginning to compost food waste		Composting Cafe food	Composting Cafe and patients food
COMPOST	Renewable energies			
			Compost used in self sustaining produce display	Compost puck for Metaflora
				Bio-degrading at extreme speeds
FARM	Green wall education tool			
			Autonomous growth of self sustaining produce	Self sustaining farm
DRONE	Allow trend in drones to build over the next 10 years			
			Drone used in autonomous display	Drone implemented in Metaflora

METAPHORA

THE FUTURE OF HOSPITALS IS NUTRIENT RICH PATCHES

		2020	2025	2030
COLLECTION	Data Collection over 10 years			
DEVELOPMENT	Research and developent around nutritional readings		Patch that is able to read the nutritional levels	Metaphor Concept

To implement our 2030 concept, Metaphor, we have looked at two other key time periods, 2020 and 2025. We have used these two important touchpoints to be able to justify the implementation of our concept and the integration of such radical ideas into the societal values of that given time. In highlighting these areas we are able to gain an understanding of how our concept will evolve over the years and how our concept can be part of the infrastructure of hospitals in the future.

Through researching and looking over documentation created by professional futurists we used this information to help guide and mould our future scenarios, giving us insights into these time periods making it possible to implement our final solution.
Much of our forecasting came from CSIRO's , Australia 2030 Navigating our uncertain future, report and from our models PESTLE diagrams.

2020

AWARENESS AND UNDERSTANDING

Our main aim behind this first touch-point is to create better awareness and understanding through creating subtle and simple changes to begin the implementation of Metaphor. In 2020 data collection and analysis of this data is imperative to the development of our concept. The data collection hub is known as the HIVE. Through using CERN's ROOT, Actiwiz 3 and FLUKA technologies we can gather the food wasted from patients, staff and family members/friends and analyse the ratios of the initial food served versus the amount left over after the individual is finished with the meal. The combination of these three technologies as well as a generic artificial intelligence system overlay gathering and learning from the data, our system will be able to track behaviours and patterns in individuals with various conditions and in certain circumstances.

We would be looking towards purely CERN's technologies as our main resources for 2020 to 2025, as well as professionals in the software engineering and Internet of Things industry to analyse and maintain the technologies. We would also be beginning to develop an interface for the HIVE. With the rise in e-health, it is required that we have a user friendly interface for this data analysis and gathering to be easily delivered to and understood by individuals involved in this part of the implementation process.

2025

NORMALISING AND MITIGATING

The second touch-point of our implementation plan is 2025. The focus behind this touch-point is normalising specific components of our design that may seem out of place in its environment, along with mitigating as much food waste possible. Stepping up the efforts of utilising food waste, the hospital cafes food waste are composted. This compost is then implemented into a small scale self sustaining plant. The plant grows and can maintain itself autonomously without the need for someone to take care of it. The purpose of this is to get an insight into patients and guests reactions along with feedback behind what have implemented. This insight should steer the solution in a firm direction.

After having collected data through the data HIVE from the years 2020 to 2025, the HIVE system is now at an intermediate level of learning. The greens we had implemented in 2020 are still a key tool in providing education to those who interact with it, but also to normalise greenery and foliage being accepted as something that is meant to belong in that space We are liaising at this point a lot with drone manufacturers and designers, farmers, IoT professionals and software engineers in order to successfully implement and test this part of the implementation process. Key resources we are utilising are specific seeds from seed depositories for the green walls and assistance from professionals and experts.

2030

THE FUTURE OF FOOD IN HOSPITALS

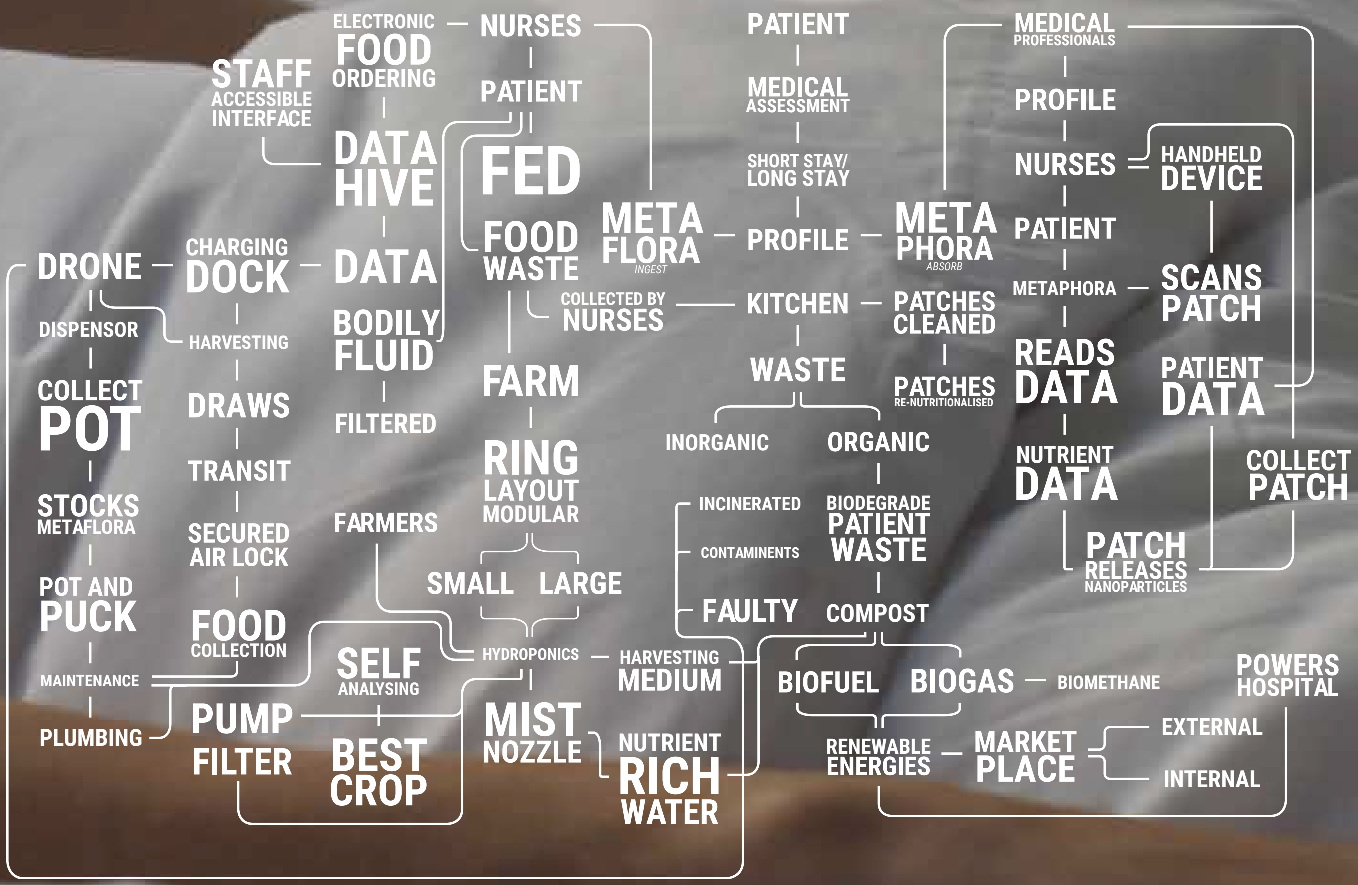
By the year 2030 we will have been consistently gathering data into the data HIVE of the hospital and have done ample user tests using drones and green walls as tools for education in order to gauge people's reactions to such concepts and what improvements we could make or things we could change. We would implement the fully functioning Metafloras into the hospital, retrofitting them for the moment into inner-city Melbourne Public Hospitals. The drones will be functioning off data from 12 years of machine learning, as well as the Metaphora scanner working off this predictive data also.

Having strategically implemented touch-points spread over a wide array of themes that were present in all our concepts we were able to build up the multi faceted design with extreme precision and purpose. The idea of having the design accepted in such an environment was supremely important in the predicted success of Metaphor as a solution into eliminating food waste in hospitals.

Having now reached the year 2030 we would predict that better technologies will be in circulation today that create an even stronger case for our solution to be implemented.

SOLUTION

Our holistic solution to food waste in hospitals is called the Metaphor. Metaphor is a multifaceted approach to food waste in hospitals aiming to help all patients from various dietary backgrounds enjoy their hospital experience. It also aims to reduce the strain on current agricultural methods in Australia, alleviate the strain on the medical staff in hospitals as a result of a growing and ageing population, as well as reduce Australia's growing contribution to food waste in landfills. The Metaphor breaks down into two further concepts; the Metaflora and Metaphora. The Metaflora is for those who ingest their food whilst the Metaphora is for those who absorb their food. The reasoning behind this two-system design solution for food waste in hospitals is due to the fact that we wanted our design concept to be inclusive in nature and provide the optimal hospital nutrition experience for all users. Through the insights we gathered over the duration of our project, we found that to tackle this solution we had to come at it from the perspective of users who were in various circumstances. It is for this reason that both the Metaphor and Metaflora had to be adaptable, dynamic and symbiotic with patient needs, so as to be future-proof and flexible.



METAFLORA

Metaflora is a modular hydroponics system which is connected to the data hive of the hospital. It is one of the two steps that are being taken in our concept to address food waste in hospitals. It is an adaptable and dynamic system, which grows its plants with accordance to patient orders, creating an equal ratio of supply versus demand. This in itself aids in less food being wasted. The Metaflora is made up of aeroponics rings, which are modularly attached to the centre water pipe. This pipe outputs a liquid fertiliser into the aeroponics rings and onto the plant's root systems through small nozzles.

By 2030 all hospitals will work under an electronic system (Stergiou, 2018), and it is for this reason that Metaflora will be able to adapt to patient orders and grow the required produce. Once the patient places their food order electronically, input to the data hive. The information is then analysed by the CERN technology and Artificial Intelligence of the Metaphor data hive and output into the Metaflora farm. Once this has been done, drones - which also work off the data from the data hive - will be prompted to plant, maintain, monitor and harvest the produce from the hydroponics farm. This, coupled with the hydroponics method of farming will grow produce at a rapid rate, much faster than current day hydroponics farming methods.

The plants which are planted in the farm are put in place through the use of compost pucks, which are placed inside shells. These shells with the compost and new seedling in them are carried by the drones and placed in the hydroponics farm slots. The compost itself is comprised of the food waste from patient's meals, as well as staff and family member/friend's meals. The food wasted is decontaminated through a series of CERN technologies and machinery, stamped into their circular shape, placed into the shells, and then the seedlings are impregnated into these composted disks.

In the instance where the farm detects a contaminated compost disk or plant, the drone will be notified and will remove the contaminated item from the Metaflora and place it inside the contamination drawer in the base of the Metaflora. A maintenance worker will be notified to remove the contaminated contents from the draw and incinerate them for later use.

When the storage drawers of the Metaflora farm are filled to the brim with fresh produce harvested by the drones, the maintenance worker will also be notified to they may collect the fresh produce and take it safely to the kitchen where it can be prepared.

The bodily waste produced by patient's and other individuals in the hospital is also incinerated, decontaminated and used to fertilise the plant's root systems.

What is produced is a closed-loop self-sustaining hydroponics farm within a hospital context. These farms can be retrofitted or added during construction of newer hospitals as they are modular in design. Metaflora enhances the patient's experience and provides better control in food consumption and production and produces zero waste removes waste.

1:1000 Scale Model of Alfred Hospital, exploring retro fitting in existing architecture.

THE FUTURE IS HOSPITAL FARMS

The Metaflora is comprised of modular hydroponic rings. These can be custom built for specific spaces within hospital environments. There are two Metaflora designs. A large farm and a small pillar farm. Within the context of an older inner-city Public Melbourne Hospital, a large farm with two rings that are 6.4 meters in diameter has the potential of yielding 160 crops at any one time. The smaller pillar design that is 1.2 meters wide would be capable of holding 40 crops in this type of hospital context.

It is important to note that the modularity of the Metaflora rings and design means that new hospital builds or newer hospital retrofits may be able to have Metaflora columns/rings that can reach higher amounts of yield due to higher ceilings and larger spaces inside the hospitals.

When faced with smaller and even more confined spaces when retrofitting, the rings can be assembled and disassembled into each of their four quarter rings. Essentially, one whole small pillar Metaflora could be assembled as a half and placed flush against a wall, and then reduced in size even further and placed in the corners of spaces by utilising only one quarter of the farm. This modularity also applies to the large Metaflora. Each of these rings are easily manufactured, compact for shipping and can be easily mounted together. An added benefit for this modular design is the ability to disassemble the rings for maintenance and cleaning.

Hydroponic is a Latin word for "working water" and is also known as a simple farming method for growing plants without the use of soil. We chose using hydroponics - specifically the aeroponics form of hydroponics - over traditional soil farming due to the difference in crop growth rates through the use of hydroponics. Hydroponics can have better yield, richer and better plant growth and only need nutrition solutions which consist of water and fertilizer.

In most normal growth, there are three main nutrition of fertilising a plant; nitrogen, phosphorus and potassium. The main difference with hydroponic fertilisation is that there is better control of input of micronutrition. However one of the biggest factors of hydroponic farming is controlling pH levels. Plants can lose its ability to absorb different nutrients when the pH varies.

Due to the installation of farms in hospitals, one of the biggest challenges is preventing cross-contamination inside the farm so as to reduce the risk of food infecting patients with diseases or bacteria. It is for this reason that drones have been the farmers of choice for our Metaflora concept. Our drones will plant, maintain, monitor and harvest the produce inside the farms. They will have the ability to detect contamination and remove it before it infects anything else.

With regards to the plausibility of drones being accepted into a hospital environment, it has been predicted by Thomas Frey from the DaVinci Institute from the United States that people will rely on drones and sensors in order to live and do their daily tasks by the year 2030. "Emerging technology" will take over jobs whilst giving "society superhuman abilities and instant access to think". Not only this, but Frey also predicted that during 2030 worldwide there will be one billion drones.

The drones are built with a light body, full face display and fanless blade turbine for flight. A fanless blade turbine was a radical concept developed to see whether or not the future would still use fan blades as a method of flight. Having fanless turbines would mean less disruption and destruction of plants also. The influence for this direction was from the bladeless "Dyson" fan.

The drones are controlled by the data hive, which gathers, analyses and outputs specific data gathered relating to the function of the metaflora. They have a pair of arms with two fingers that carry and harvest the potted plants. These fingers would open in position The drones are built with a light body, full face display and fanless blade turbine for flight. A fanless blade turbine was a radical concept developed to see whether or not the future would still use fan blades as a method of flight. Having fanless turbines would mean less disruption and destruction of plants also. The influence for this direction was from the bladeless "Dyson" fan.

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The drone are also adaptable as they can fit in both large and small Metafloras. The drones have two different states; "bound" and "free".

The "bound" state is when the drone is in a vertical position with a vertical face display, allowing it to safely fit within the small pillar farm. The small pillars have 400mm between the hydroponic rings and the glass glazing. When in the small pillar farm the drone takes on the vertical position; the arms move into a position with the plant pot being held in front of the drone's body. The bottom turbine then turns and hovers using fine-tune correction in order to balance itself whilst holding the pot.

The "free" state applies to the large Metaflora pillar and large farm. In the large hydroponic, the distance between the glass glazed is 700mm. The drones will work together, like a colony of bees, harvesting and maintaining the planting, growing and harvesting processes of the Metaflora farms.

The compost which goes into the compost disks is created through the use of food waste from patients, staff and family member/friends. The food wasted is sent to the CleanTechnica Anaerobic digester. The food waste is, as the name states, anaerobically digested and turned into fertile compost. This compost is then liquid-solid separated, and the left-over solid compost is stamped and turned into the compost disks, which are then impregnated with various plant seeds, placed into pots and put into the hydroponic rings in the Metaflora by the drones. The disks are stored by the maintenance workers in one of the Metaflora drawers. When there are very few disks or pots left, the maintenance worker is notified and they can restock the drawers.

The anaerobically composted food waste that will be used to create the compost disks for the pots is first taken through a process of liquid-solid separation. This is done so as to create solid compost for the disks and to create liquid fertiliser for the hydroponics fertiliser mist that will be sprayed onto the plants' root systems.

Some of the food waste is sectioned off using CERN technology to separate it. This part that is sectioned off is put into the biogas converter; the HORSE made by CleanTechnica. This machine will take the food waste, take it through a process of anaerobic digestion, go through gas treatments and digestate treatments and then create biomethane. This biomethane is then stored in high-pressure cylinders and used straight away or when needed by the Metaflora.

The marketplace is created through the harvested produce, production of compost, liquid compost fertiliser and biomethane created in the Metaflora farms. In 2030 when the Metaphor has been retrofitted, adapted to and built with new and existing hospital structures, Australia will be in a position to commence the Metaphor Marketplace. The marketplace will be a way to develop a sense of community between hospitals, allowing them to trade their products with each other. For example, if one hospital has a lot of biomethane but not enough harvested produce, they can trade their biomethane with another hospital which may need it, and get more harvested produce in return. This way, a self-sustaining community is created.

The farm has a symbiotic relationship with the patients, as patients have the ability to control what is planted in the farms. The way this is done is through the electronic menus, within which patients will input their food orders. What is created is way for the patient to feel as though they are involved in a growing and nurturing process as they can see some of the ingredients of what they ordered being harvested and grown within the farms. This is a feeling of power that can at times be lost within hospitals (Stergiou, 2018) as patients can feel disempowered in their environment.The patient's bodily fluids are also used to be converted into the liquid fertiliser used as the mist which is sprayed onto the plants' root systems, again contributing to the patient's sense of empowerment.

Added benefits of greenery within interior spaces in hospital environments are the following:

Psychological and Health related

Improve well-being
Lower levels of anxiety
Fewer feelings of homesickness
Clean air/air filtration system
Natural air cooler

(Blaschke, 2018)

CERN TECHNOLOGY

Due to the use of compost from patients CERN technologies will have the ability to detect unnatural or potentially harmful microbes that were not killed during the anaerobic digestion composting stage. Last resort method if undetected before entering farm. The types CERN technology which were implemented into Metaflora were:

ACTIWIZ3

The Actiwiz3 is a software graphical interactive user interface. This is implemented during the beginning of 2020, collecting and assessing data of the amount of food waste that will be produced till 2030.

Actiwiz is able to detect whether the nutrition spray is functioning at an efficient rate and know when something has been blocked, jammed or has any contamination within the nutritional fertilised water. This allows the drones and maintenance works to be notified of any significant function or malfunction in the farm

ROOT

In par with ActiWiz, Root is a software that will help categorize and organize large amounts of data, and is then sent back to the hive where the the information is stored. Root helps ease the overall system by grouping the data and splitting it into different categories. Due to the overall farm being greatly controlled by AI and other CERN technologies, mass influx of data can slow down process time, however Root helps control the mass data and thus allows the whole system to run with ease.

FLUKA

In combination with ActiWiz and ROOT, FLUKA will be able to further support these softwares by being able to determine the ideal pairings or plants with regards to what grows best together and in which ideal environments. This creates more stability in the decision making for the drones when planting and harvesting the crops.

DATA CENTRE ENVIRONMENTAL SENSOR

The Data Centre Environmental sensor is a technology that has the ability to detect temperature, air density, particle density, moisture and dust particles. The sensor helps the farm greatly by detecting the condition of the farm, sending the information to the hive.

The information is then sent to other sensors and technologies and make the needed adjustments to the farm, returning it to a stable and suitable state.

C2MON

In combination of the data centre environmental sensor, C2mon would assist by monitoring and controlling the sensor and make the required adjustments. This tech acts as a decision maker as it received continuous data from multiple sensors and techs. It also has the ability to multi task and make particular decision which would benefit the farm

GEMPIX3

Gempix3 is used to detect and monitor gases within the composting process. This allows better awareness and control of what gases are produced while the compost is being processed and what gases are separated. (Eg. natural biogases turning into biomethane gas). This is then linked and controlled by the hive and sent to other machines in order to collect and store the gases.

VALUE PROPOSITION

The Metaflora provides patients, medical staff and hospital visitors with a more relaxed environment due to the innate calming properties of greenery within indoor spaces. The farms themselves are natural air filters and air coolers, providing the indoor space with clean air and comfortable temperatures for those inhabiting it. Fresh and organic produce is delivered straight to the patients, staff and visitors, which are also higher in nutrition due to the hydroponics farming system. When all hospitals have adopted this system, the community benefits from the Metaflora marketplace. The Metaflora marketplace is a way in which hospitals can trade their supplies - such as biomethane cylinders, fresh produce, compost and liquid fertiliser - with each other, exchanging their excess of one thing for something else they may be low in. What is created is a sustainable community that not only benefits those who reside within each building, but benefits all by facilitating a supportive environment.

Metaphora in use in a local hospital, nutrionalising patients through appendaegal route

METAPHORA

The Metaphora comprises of two components, the Infrared handheld scanner and the silicon transdermal patch. Once admitted and assigned a bed the patient's health is analysed and they are assigned a Metaphora patch if they fall into the following circumstances: If they are advised not to eat due to medical reasons, or they do not want to eat due to personal preference

If they fall into the above scenarios, they will then be provided with a clean and recharged patch by a nurse. The recharged patch is filled with nanoencapsulated biodegradable nano-nutrients. Once the patch is placed on the patient, the nurse can then use the handheld infrared scanner to scan the patient's nutrition levels, identify their deficiencies and proceed to provide them with the required amount of nutrition through the infrared heated activation of the nanoparticles. The dosage and deployment of nutrition into the patient is identified through CERN technologies and artificial intelligence located inside the scanner making it a fully automated and efficient process.

After scanning and activating the patient's patch with the scanner, the nurse is then free to attend to their other patients and also scan/activate their Metaphora patches. Once the Metaphora patches have released all of their nutrition into the patient, this information is processed through the data hub, relaying the information directly to the nurse's handheld scanner. If the patient however wears the patch past the notification time, it is of no detriment to the patient as the patch thereby becomes deactivated and dormant.

THE FUTURE OF HOSPITALS IS NUTRIENT RICH PATCHES

The scanner is designed with a white grip gloss finish polymer, matte chalk grey texture and an inbuilt interactive glass touch screen which projects information as a hologram. The screen is a display which shows the patient's condition, health details and their nutrition levels. The scanner is also connected to a hive (centre computer hub) and relays all details of the patient onto the display. These details are either entered from past visits or linked to health/medical records. The scanner is also has an inbuilt infrared technology from CERN which has the ability to scanner the silicon nutrient patch and identify whether the patient is well nourished for not and if not, it can activate the patch and send a controlled amount of nano-nutrition from the patch through the skin and into the body. Another feature is a fingerprint detector which records which medical professional has use the scanner, which patient has been fed nano nutrition and how much they had administered. This is a safe and secure method as it only allows authorized fingerprint access.

The patch design is a skin safe white silicon with a detachable center disk. The silicon is shaped as a 'cross sign' and has the flexibility to wrap around the arm of the patient. The silicon is fixed to the skin through micro hairs (micro hair hooks) that enable the patch to have the ability to wrap and grip onto human skin. The center disk holds the brain of the patch and relays the nutritional data from the patient to the scanner. When the patch is depleted of nano-nutrients, the patch is then taken back to the kitchen, sterilized and then replenished with new nano-nutrients.

"Nanoscience the study of the phenomena at 1-100 nm Nanomaterials those which have structured components with at least one dimension less than 100nm"

"Nano-nutrition is a method of providing cells with nutritional factors, disintegrated to nanoparticles or transported by nanoparticles." (E. Sawosze et al. 2013).

Nanoencapsulation is the fastest way to deposit drugs into the body, as it increases "...drug efficacy, specificity, tolerability and therapeutic index of corresponding drugs" (Kumari et al., 2009). Nanoencapsulation involves placing nanoparticles of varying molecular states (ie. solid, liquid or gas) into the centre of an outer layer, a shell, in order to form nanocapsules (Cano-Sarabiaa, Maspocha, 2015).

Biodegradable nanoparticles are particles which, when placed into the human body, are easily accepted into the body's system and are able to be broken down into metabolic molecules, which the body can easily break down.PLGA (poly-d,l-lactide-co-glycolide) is one of the most preferred polymers to use on the exterior (shell, or matrix) of the nanoparticle. The reason it affords itself this purpose, is due to the fact that it can undergo hydrolysis. Hydrolysis is the process of water being added to a molecule, causing a chemical reaction, which can break it down. PLGA, when reacting with water, is broken down into Lactic and Glycolic Acid, acids which are easily metabolised by the body naturally.

By coating the shell of the nanoencapsulated nanoparticle in a hydrophobic coating, the nanoparticle is able to pass through the body with much more ease and speed.

The nanoencapsulated biodegradable nano-nutrients are stored inside a layer of the silicon transdermal patch, sitting comfortably within a layer of nano-sized pockets in the patch. These holes will have a specific amount of vital nutrients stored in them, locked, loaded and ready for deploy into the patient's body, with accordance to the patient's nutritional needs. When the infrared scanner heats up the calculated amount metallic nanoparticles, the smart technology behind the Metaphora will be able to activate specific amounts of various nutrients, deploying the specified dosage into the body's system. The deployment is through an in vivo, transdermal application. Much like how nicotine patches work, the array of nano-holes containing the nanoparticles are deployed through the patch via the adhesive side of it. The nanoparticles are controlled in their deployment throughout the duration of the day in order to satisfy and maintain the patient's nutritional needs throughout the day.

Metallic Nanoparticles include minerals such as gold and silver. The specific type of metallic nanoparticle encouraged for use in drug delivery is silver (Ag) metallic nanoparticles, the type that will be used in the Metaphora patch (Mirela D 2009 Metallic Nanoparticles, Slovenia: University of Nova Gorica). Ag nanoparticles (NP) are innately "antimicrobial" (Mirela D, 2009) and used currently used in the following applications:

- Water purification
- Wound care
- Medical Devices
- Drug Delivery

With a clear strength in the medical field, it is for this reason that Ag NPs were chosen to be used at the metallic nanoparticle layer in our Metaphora patch. Ag NPs also respond well to all types of wavelengths, meaning they will communicate in a highly responsive manner with the infrared light emitted by the handheld Metaphora scanner.

The localised heating of transdermal patches has been continuously proven to be a highly effective way of increasing the absorbance and delivery of nanoparticles through the skin and into a person's system (Otto, de Villiers, 2014). As stated in the paper What is the future of heated transdermal delivery systems? (Otto, de Villiers, 2014) "For most drugs, the solubility can be significantly enhanced by an increase in temperature...larger doses of drugs could potentially be delivered at higher rates compared with an unheated patch or other topical delivery systems."

Currently (2018) heated transdermal patches that contain metal nanoparticles can be illuminated "...with infrared light to generate heat for as long as illumination is applied." (Otto, de Villiers, 2014). Knowing that heat increases the delivery of nanoparticles past the epidermis, dermis and into a person's system, we therefore predict that by 2030 this heated transdermal delivery through infrared technology will be advanced enough that specified dosages of nutrition into patients will be possible. The ideal size of the Ag NPs would be 70nm and would enter through the hair follicles on the skin, followed by an intracellular translocation into the bloodstream (Palmer, Delouise, 2016).

1:1 Scale models of the Metaphor patch and scanner being apploed, activated and waiting to be replenished.

CERN TECHNOLOGY

ROOT

The ROOT IT system from CERN is a system that gathers data and categorises it based off the properties of that data. This categorisation via data properties allows for the Actiwiz (below) to analyse and predict data trends, which, when coupled with Artificial Intelligence technologies, will provide the Metaphora with predictive calculation abilities to assist in nutritional nanoparticle delivery. The ROOT IT will be located in the data hive of the Metaphor solution, where data is stored, analysed and delivered back to the Metaphora with a specified output. (https://kt.cern/technologies/root)

ACTIWIZ3

Actiwiz 3 is currently being used for fast comparative analysis of radiological hazards within the Large Hadron Collider (LHC) at CERN. It has the ability - within its current context - to calculate the hazard risks of endless chemical and material combinations before these combinations are made by the user. Within the context of the Metaphora, the Actiwiz 3, coupled with the ROOT IT system and FLUKA will allow for an in-depth analysis of various nutritional nanoparticles before they get delivered into the patient, or even before they get placed into the patch.

This way, risks such as allergic reactions to patches and fatalities from nutritional combinations/overdoses done usually through human error will be made obsolete. The predictive capabilities of the Actiwiz 3 in combination with the other CERN technologies will also mean a perfect calculation of the required amount of nutrition and the types of nutrition a patient needs can be verified. (https://kt.cern/technologies/actiwiz)

FLUKA

FLUKA acts as a programming tool to further analyse and calculate interactions between particles and matter. It is able to simulate interactions between matter prior to them actually occurring, assisting in further specifying the predicted outcomes from the Actiwiz 3. It would be used in collaboration with the Actiwiz 3 and ROOT to provide the data hive of the Metaphor with accurate data to then output to the Metaphora scanner and patch. (https://kt.cern/technologies/fluka)

MEDIPIX3

Medipix3 is a 256x256 channel hybrid pixel CMOS pixel detector designed with a segmented semiconductor sensor. It acts as a camera, taking based imaging on the number of particles when an electronic shutter opens. This works on a readout chip using single photon counting modes with a new inter-pixel architecture. This aims to improve the energy resolution in pixelated detectors by mitigating the effects of charge shared between multiple channels. This camera sensor technology would be incorporated into the metaphora patch technology as a way to detect and provide information on the patient's nutritional status so as to further inform the infrared scanner of how much nutrition and infrared is required for that specific patient.

ARTIFICAL INTELLIGENCE

A generic Artificial Intelligence system will be applied to the CERN technologies and will be fitted into the hospital's data hive. This AI system will be programmed with highly complex algorithms, allowing it to dynamically approach various situations in order to produce the correct and ideal outcome for patients. The AI system will gather the data from the combined efforts of the Actiwiz 3, ROOT and FLUKA (which have derived their data through the nutrition readings done by the MediPix and the blood nutrition analysis device), analyse this data and output it to the handheld scanner the nurses will be using. This AI system will act at the glue tying all the data from the CERN technologies and other technologies together.

NON INVASIVE ANALYSIS

The current method for blood nutrition, fat and protein analysis is called a Plasma Protein Analyser. These analysers are able to determine qualitative, quantitative and functional levels of various samples (assays). Plasma Protein Analysers "... are capable of accomplishing all of these assays to help manage cardiac risk, kidney diseases, or nutritional problems in patients." (https://www.labcompare.com/Clinical-Diagnostics/5114-Plasma-Protein-Analyzers/)

This being a technology which currently exists, we predict that by 2025 we will be able to manufacture a Plasma Protein Analyse which would be small enough to fit discreetly into the Metaphora patch. By 2030 we would be able to then have this technology be able to read a patient's nutritional, protein and fat levels without invasive injection methods and be able to relay this information to the data hive of the Metaphor.

Metaphora in use in a local hospital, nutrionalising patients through appendaegal route

VALUE PROPOSITION

Metaphora provides patients who have to absorb their food a way to do so without being too medically invasive. It is an ergonomic way for patients to absorb their required nutrition on the go. Its flexible design means it can move with the user. It mitigates any food that may be wasted due to patients not having an appetite or not being able to ingest their food. The typical current-day methods of liquid diets (IV drips and Percutaneous endoscopic gastrostomy (PEG)) can also at times be pulled out by patients who do not want this more invasive method of liquid diet, resulting in wasted nutrition and contamination from factors such as open wounds from the injections and tubes. Metaphora does not require needles or tubes to go into the patient's body in order to deliver nutrition, providing the patient with a much more comfortable hospital experience. Metaphora's ability to be reused through a rigorous sterilisation process means that it is also a very sustainable and environmentally friendly way to provide nutrition to patients who are required to absorb their nutrition. Due to this process, factors such as cross-contamination are made obsolete. Cross-contamination is also no longer a factor as the patch does not come in contact with any bodily fluid such as blood during application. We foresee that the larger community will eventually benefit from the Metaphora as it becomes - beyond 2030 - a patch which can be used at home, in rehab or even on the go as a more daily-use device.

FUTURE

The Metaphora comprises of two components, the Infrared handheld scanner and the silicon transdermal patch. Once admitted and assigned a bed the patient's health is analysed and they are assigned a Metaphora patch if they fall into the following circumstances: If they are advised not to eat due to medical reasons, or they do not want to eat due to personal preference

If they fall into the above scenarios, they will then be provided with a clean and recharged patch by a nurse. The recharged patch is filled with nanoencapsulated biodegradable nano-nutrients. Once the patch is placed on the patient, the nurse can then use the handheld infrared scanner to scan the patient's nutrition levels, identify their deficiencies and proceed to provide them with the required amount of nutrition through the infra-red heated activation of the nanoparticles. The dosage and deployment of nutrition into the patient is identified through CERN technologies and artificial intelligence located inside the scanner making it a fully automated and efficient process.

After scanning and activating the patient's patch with the scanner, the nurse is then free to attend to their other patients and also scan/activate their Metaphora patches. Once the Metaphora patches have released all of their nutrition into the patient, this information is processed through the data hub, relaying the information directly to the nurse's handheld scanner. If the patient however wears the patch past the notification time, it is of no detriment to the patient as the patch thereby becomes deactivated and dormant.

METAFLORA STAKEHOLDERS

With regards to the development and eventual functioning stage of the Metaflora, much like the Metaphora, data collection and analysis is imperative from 2020 until 2025. Stakeholders involved in this highly important process are Software engineers, Artificial Intelligence experts, Dieticians, Nutritionists, Public Hospital/Healthcare support, Government support and individuals from the Knowledge Transfer sector at CERN to assist and advise on the methods of data collection for food waste. Once this data has been collected, we will gain the insights and support from the Environmental Protection Agency, the Victorian Government Agricultural Sector, Farmers, Seed suppliers, Agronomists, Arborists, Hydroponics experts, Drone manufacturers, Product designers, Architects, Medical Staff, Tooling developers and landfill industries.

METAPHORA STAKEHOLDERS

For Metaphora to succeed from the moment data collection begins to when it is implemented in its fully functioning patch and scanner in 2030, we require specific stakeholders to be on-board. In the initial phases of data collection we will require Software engineers, Artificial Intelligence experts, Dieticians, Nutritionists, Public Hospital/Healthcare support, Government support and individuals from the Knowledge Transfer sector at CERN to assist and advise on the methods of data collection for food waste, as well as data on patients' feelings/reactions towards current methods of liquid diets in hospitals. Once this initial data collection phase has been completed from 2020 to 2025, 2025 until 2030 and onwards will require input from far more stakeholders. We will require support and assistance from the Environmental Protection Agency, Injection Moulding Industries/ Manufacturers, Transdermal patch manufacturers, Nano-technicians, the Nanomedical industry, Medical Staff, Biologists, Product designers, Tooling developers and landfill industries.

RANKED STAKEHOLDERS

PARTNERSHIP

METAFLORA:

Public hospitals
Government
Healthcare

METAPHORA:

Public hospitals
Government
Healthcare

PARTICIPATION

METAFLORA:

Compost/fertiliser manufacturers
Chefs cooking food
Food Standards Australia and New Zealand
Patients (ingest)
Biodegrading waste management

METAPHORA:

Patients (absorb)
Metaphora patch Chef
Medical Labs

CONSULTATION

METAFLORA:

CERN
UN
Agronomists
Waste management
Coding/Software Engineers

METAPHORA:

Nanomedicine
CERN
UN
Waste management
Coding/Software Engineers

PUSH COMMUNICATION

METAFLORA:

Helen Stergiou (Head of Trauma Alfred)
CSIRO Future Forecasting
Designers
Landscape Architects

METAPHORA:

Helen Stergiou (Head of Trauma Alfred)
CSIRO Future Forecasting
Designers
Transdermal patch manufacturers

PULL COMMUNICATIONS

METAFLORA:

Nurses
Andrew Woll (Royal Children's' Hospital)
Sarah Blaschke (Peter Mac Cancer Centre)
Hydroponics farms
Medical Staff
Sam Olive Farmer
Australian Synchrotron
Landfill Organic Waste
Family and Visitors of Patients
Arborists
Gardener
Builders/contractors
Pre-fabrication designers
Modular Designers
Farmers

METAPHORA:

Silicon moulding manufacturers
Injection moulding manufacturers
Tooling Engineering
Maintenance
Particle Physicists
Hospitality workers
Nurses
Andrew Woll (Royal Children's' Hospital)
Sarah Blaschke (Peter Mac Cancer Centre)

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