BRAINWAVES
Agri Prospecting
Archwilio Amaethyddol
Taiscéalaíocht Talmhaíochta

Newsletter 6

November 2023

Welcome to our final Newsletter!

Project Partners

UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh | School of Biological, Earth and Environmental Sciences

Environmental Research Institute

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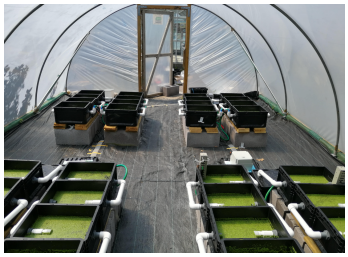
A reflection on 3 years of Brainwaves

From Principal Investigator Prof Marcel Jansen

It is now some 5 years ago that the original idea of what would become the Brainwaves project was first conceived. So, what has happened since, what was achieved, and what remains to be done?

In 2018, original ideas about protecting the environment, retaining plant nutrients rather than unsustainable mining for new fertiliser ingredients, and achieving value from waste using duckweed were very attractive. With hindsight these original ideas were (and are!) very much in tune with developments, problems, opportunities and visions for the agricultural sector. Also, these ideas were (and are!) very much in line with the concept of the "Circular Economy", a widely accepted principle which involves re-using, repairing, refurbishing and recycling existing materials and products as much as possible. The Brainwaves project has demonstrated that duckweed can be grown on a variety of different aqueous waste streams, cleaning the water, retaining the nutrients, and generating protein-rich biomass that can be used in animal feeds. To do so, the Brainwaves team has developed both indoor and outdoor bioreactors, facilitating both capital intensive, year-round cultivation as well as low cost, seasonal cultivation in applications in industry and on farms.



While the focus on the circular economy may suggest an element of foresight, if so, this was only a very partial foresight! Indeed, few of us could have predicted the Covid19 pandemic which massively impacted society, including very substantially the Brainwaves project. A project with a strong emphasis on engaging with societal and commercial stakeholders needs face-to-face communication. Indeed, one lesson from the Covid19 pandemic is how critical face-to-face communication is for getting things done!

Another major change which impacted on the Brainwaves project was the massive increase in fertiliser cost, linked amongst other things to the war in Ukraine. Thus, in a short time-period, the perspective of animal slurry changed from that of a waste product to that of a critically important, and valuable fertiliser. This affected the Brainwaves project which had initially focused on the concept of slurry as a waste product to be valorised using duckweed. The project team responded to this changed environment by focusing increasingly on other agri-food waste streams, and particularly on more dilute yard washings from dairy farms. Indeed, one of the lessons from the Brainwaves project is that duckweed-based remediation is a concept that can be used to retain nutrients, and generate valuable, protein-rich biomass from a wide variety of different agri-food waste streams.

This perspective is now further elaborated in two newly funded projects: The Duck-Feed project (https://www.ucc.ie/en/duckfeed...), funded by the Irish Department of Agriculture, Food and the Marine, explores how a variety of

farm waste streams can be valorised using duckweed, with more detailed focus on design of incubators, the variety of waste streams, and protein quality. The IMPRESS project (https://impress-he.eu/) is funded through HorizonEurope and includes the valorisation of aquaculture processing wastewater using duckweed.

Perhaps just as valuable is our close collaboration with the team of the Green Farmer Cooperative (Co. Tipperary) (https://greenfarmercoopltd.eu/) who are now implementing duckweed cultivation on a dairy farm.

So, it appears that duckweed is here to stay. Indeed, both in our conversations with the general public, as well as with stakeholders, there seems to be a rapidly increasing awareness of what can be done with duckweed, and how duckweed can be exploited to address some of the key challenges facing Irish agriculture. We are grateful to social media, newspapers and broadcasters for the opportunities that we have had to engage with the wider public, it is these interactions that have inspired and motivated us. With the Brainwaves project at an end, but both Duck-Feed and IMPRESS projects continuing the work, we are as keen as ever to engage with the wider public, media and stakeholders. Please feel free to contact us, always happy to chat!

Below: Prof Marcel Jansen checking out the Duckweed growth on aquaculture water

Project Reflection

From Co-Principal Investigator Dr Dylan Gwynn Jones

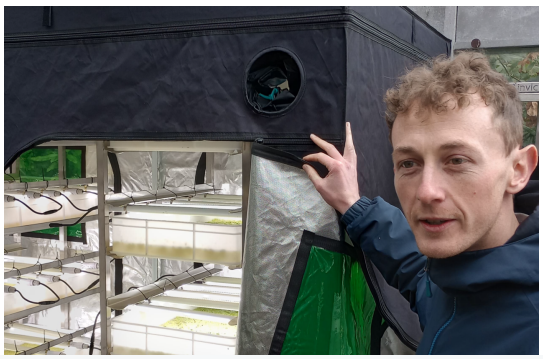
A few years ago, a seminal paper on duckweed biology was published, entitled "*Return of the Lemnaceae: Duckweed as a model plant system in the genomics and postgenomics era*". The title, apart from clear Star Wars annotations, captures the amazing return of Lemnaceae to the research-and-application limelight. Indeed, this is not the first time that duckweed research is capturing worldwide attention. In the 1960s, 70s and 80s duckweed was considered a great model system for plant physiological studies, and much of

what we now know about biosynthesis of, amongst others, plant hormones, was discovered in those heady years using duckweed. Duckweed was a great model system due to the ease of manipulation, and the rapid uptake of a variety of chemicals from the growth medium.

This incredible ability to absorb chemicals from the medium is now once more in the limelight in the context of water remediation. The newsletter of the International Steering Committee on Duckweed Research and Applications "The Duckweed Forum" lists around 100 newly published duckweed papers each year, with a substantial portion focussing on applications such as remediation and, most interestingly, duckweed protein production.

Progress is not limited to academic research, with substantial industry activity as well, particularly in the USA and Israel. The rapid development of the "Plantible Foods" facilities in Texas show the potential of duckweed-based protein production, while GreenOnyx in Israel pioneered year-round duckweed culturing under sterile conditions of one of the smaller duckweed taxa, Wolffia. Both GreenOnyx and Plantible Foods are essentially food-producing companies, and it is encouraging that the European Food Safety Authority has now also approved the first applications of duckweed-derived protein for food use in the European Union. These developments are very encouraging, nevertheless, an important challenge remains; linking wastewater remediation with protein production. This was a key area of research for the Brainwaves project team. We worked to identify suitable waste streams to grow duckweed as a protein source for agri-feed and food-applications, both in terms of food safety as well as public acceptance. A good candidate waste stream is dairy processing wastewater (i.e. whey) which is essentially clean waste from a food-grade material. Our research was focused on finding the ideal conditions for optimal duckweed growth on such waste. The challenge is substantial, but ultimately the reward will be worth it, with a more circular, sustainable agri-feed sector which will benefit us all.

Below: Post-Doctoral Researcher Gruffydd Lloyd- Jones at the Duckweed growth facilities at Aberystwyth University, Wales



Brainwaves Video Lab to Farm

We are excited to share our final Brainwaves video! At Brainwaves we have developed systems to use duckweed for water remediation & have been busy growing duckweed in indoor and outdoor laboratory situations.

Now we are starting to scale this system up and are moving the technologies that have been developed in the laboratory to real world setting on farms. We spend a day on site recording this final video on a local dairy farm in Clonmel, Co. Tipperary.

Below: The Brainwaves media stars enjoying a day of filming!

Duckweed as a novel protein crop for Ireland

Above: Local dairy farmers gather together in UCC to discuss the future for integrating duckweed cultivation in Irish farming

We were delighted to recently spend a fruitful day with local dairy farmers at the Brainwaves stakeholder engagement event in UCC.

At this informal event Prof Marcel Jansen presented on some of the new opportunities for integrating duckweed cultivation in Irish farming. PhD candidate, Cian Redmond, discussed the results from his reserach conducted by growing Duckweed on waste water streams collected from local dairy farms. Stephen O'Sullivan presented on the story of the Green Farmer Cooperative, and their work on duckweed as a cash-crop for dairy farmers. After the informal talks we embarked into the Indian summer sunshine for an informative tour and demonstration of the Duckweed Growth Facilities both in the labs and glasshouses at the School of Biological, Earth and Environmental Sciences.

Duckweed Research and Applications for the Circular Bioeconomy in Ireland

Above: Group Photo of the Brainwaves Team and Workshop Delegates

In Ireland, interest in duckweed research and applications has steadily grown over the years. However, research and development efforts are somewhat scattered, with sometimes a lack of joined-up thinking. To bring key stakeholders together, as well as to bring in best international expertise, a one-day workshop on “Duckweed Research and Applications for the Circular Bioeconomy in Ireland” was organised at University College Cork (UCC) in the south of Ireland on the 9th of June 2023.

A busy day at the Royal Welsh Show 2023

An early start for the Aberystwyth Brainwaves team on Tuesday 25th July as they headed off for the Royal Welsh Show.

Dylan’s day kicked off with an interview with BBC Radio 4 for ‘Farming Today’ talking about growing duckweed as a source of protein for animal feed, which was broadcast the following morning as part of a series of interviews from around the show.

The team were then joined by stakeholders who have worked with Brainwaves and representatives from Welsh Government, Natural Resources Wales, Coleg Sir Gar and Farmers Union Wales. The theme for the meeting was ‘Developing a Circular Economy in Welsh Farming’. After a presentation by Dr Gruffydd Jones on our ‘ Brainwaves Journey’ a lively discussion on the barriers to the creation of a circular economy took place.

Above: Dr Dylan Gwynn-Jones c/o PI, being interviewed by BBC Radio 4 for 'Farming Today' at the RWS 2023

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Celebrating Ireland Wales Co-Operation

Above: (Top) Group photo of all the Ireland Wales project managers (Bottom left) Brainwaves Project Manager, Siobhan Higgins, and AU Local Project Manager, Lesley Langstaff, with the Project's Development Officer, Samantha Richardson (Bottom right) Brainwaves Project Manager, Siobhan Higgins chatting with the ECHOES project team.

Brainwaves Project Manager, Siobhan Higgins, and Aberystwyth University Local Project Manager, Lesley Langstaff, represented the Project at an event to celebrate the success of the 2014-2020 Ireland Wales European Territorial Co-operation Programme which was took place in Portmarnock, Dublin on 23rd June.

The event, compared by Newstalk's Jonathan Healy, provided the stage for project beneficiaries in Ireland and Wales to talk about their experiences of working together across the Irish Sea, following opening video addresses from Mark Drakeford the First Minister of Wales and Pascal Donohoe, Minister for Public Expenditure, National Development Plan Delivery and Reform in Ireland.

The Brainwaves Project had a popular exhibition stand at the event, and Siobhan and Lesley enjoyed meeting up face-to-face with the Project's Development Officer, Samantha Richardson, as well as with representatives from other Ireland Wales projects.

Continue to stay in touch: Introducing New Funding Streams!

Although the Brainwaves project has come to an end, Prof Marcel Jansen is continuing this important research through other funding streams.

The Duck-Feed project (https://www.ucc.ie/en/duckfeed...), funded by the Irish Department of Agriculture, Food and the Marine, explores how a variety of farm waste streams can be valorised using duckweed, with more detailed focus on design of incubators, the variety of waste streams, and protein quality.

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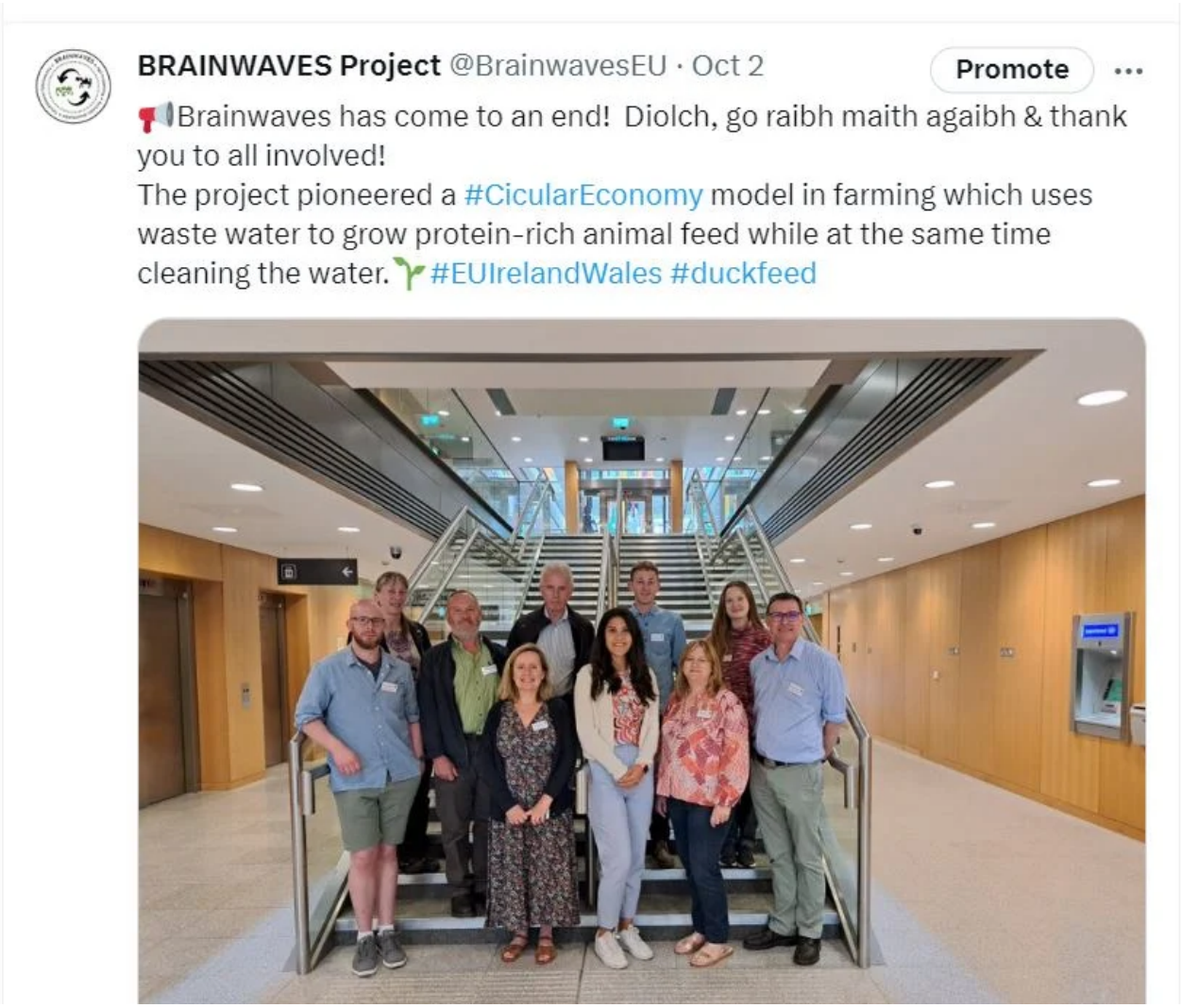
Social Media



Continue to follow Prof Marcel Jansen's research on Twitter @PLANTS_UCC.

DMs are always open if you'd like to get in touch.

Brainwaves Project Website

The project website will remain live. Find all your Brainwaves-related information and resources here.

Visit our website

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We are planning to continue the Newsletter through the Duck-Feed DAFM funded project. If you no longer want to stay in touch please unsubscribe from the Newsletter mailing list below.

Brainwaves

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