Newsletter 5

May 2023



Welcome to our latest Newsletter!



Project Partners



School of Biological, Earth and Environmental Sciences





Funded by the European Regional Development Fund through the Ireland Wales Cooperation Programme



Foreword

From Principal Investigator Prof Marcel Jansen

A few years ago, a seminal paper on duckweed biology was published, entitled "<u>Return of the Lemnaceae: Duckweed as a model plant system in the genomics and postgenomics era"</u>. 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 in the limelight 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 is a key area of research for the Brainwaves project team. We are working 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 is focusing 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.



'Picnicking across the Irish Sea' on Europe Day 2023



Above: Brainwaves Teams in UCC and AU enjoying a picnic lunch to celebrate Europe Day 2023

The Brainwaves team at University College Cork and Aberystwyth University gathered together for a working lunch to celebrate <u>Europe Day 2023</u> on the 50th anniversary of Ireland's membership to the EU.

Sticking with a European theme, UCC colleagues enjoyed a delicious Italian cuisine, *Buon Cibo*!!

The circular economy; making money out of swine waste



Above and Below Left: Pig on farmland (By Ulrich Mueller, Dreamstime) and Brainwaves Postdoctoral Researcher at University College Cork, Dr. Merve Sasmaz Kislioglu

We are excited to share with you the latest findings from our research into solutions for the slurry challenge faced by Irish pig farmers. For years, the pig farming industry has struggled with the management of the large amounts of slurry generated on, typically, small-acreage farms. Conventional methods involve storing and transporting slurry to arable farmers, incurring significant costs. However, novel approaches involving anaerobic digestion, followed by a concentrating process, are resulting in novel income from biogas, as well as reduced transport costs. The Vibratory Shear-enhanced Process (VSEP), a cutting-edge innovation, reduces the water content of anaerobically digested slurry, resulting in decreased weight and volume for transportation. This method has demonstrated significant potential in overcoming the logistical challenges faced by pig farmers. However, the filtered effluent, known as VSEP permeate, still contains high concentrations of valuable nutrients that can be harmful to the receiving environment if discharged.



To address this issue, the Brainwaves Postdoctoral Researcher at University College Cork, Dr. Merve Sasmaz Kislioglu, has focused on the potential use of VSEP effluent as a growth medium for duckweed. Duckweed is a fast-growing aquatic plant, which enables it to efficiently uptake nutrients such as nitrogen and phosphorus from the effluent. Duckweed species are widely recognized as valuable plants for wastewater remediation. Furthermore, the plant holds great potential as a protein source.

However, using VSEP effluent as a duckweed growth medium is challenging, as the composition of the VSEP effluent can vary due to various factors, including farm conditions, anaerobic digestion conditions and the specific filtration process employed. Therefore, managing the physicochemical parameters of the VSEP effluent is crucial to fully harness the potential of VSEP effluent for duckweed cultivation and sustainable wastewater remediation. Nevertheless, it is worth it, as combining anaerobic digestion with VSEP technology and duckweed-based remediation presents a unique opportunity to significantly reduce slurry disposal costs, enhance wastewater remediation, and generate valuable biomass. This approach perfectly aligns with the principles of the circular economy, fostering a more sustainable and eco-friendly agricultural industry.

We will keep you posted on any developments as we continue to investigate duckweed-based remediation of swine slurry!

Experimental Work at Aberystwyth University

Whilst outdoor duckweed growth slowed down over the winter, the previous six months have been busy at Aberystwyth with work moving indoors. In the glasshouse, work has continued on developing a portable system consisting of a bread rack trolley and several trays for indoor duckweed cultivation. In the laboratory, samples collected from the IBC-scale trial described in the previous newsletter have been analysed to assess duckweed and protein yields when grown on wastewater. Also analysed were water samples to assess duckweed's ability to recover nutrients from wastewater.





February and March were also busy months, with slurry and parlour washings collected from a total of 35 farms across Wales for an upcoming trial involving project stakeholders. Laboratory analysis of the samples was conducted for various chemical properties and nutrient content. An indoor growth trial is now underway to assess the suitability of different samples for duckweed growth.

Below: Indoor growth trials to assess the suitability of different samples for duckweed growth.



Prof Marcel Jansen appointed as member of the UNEP Environmental Effects Assessment Panel



Congratulations to Brainwaves PI, Prof Marcel lansen who has been appointed to the United Nations (UNEP) Environment Programme Environmental Effects Assessment Panel (EEAP), one of three panels that informs the Parties to the Montreal Protocol on matters arising from ozone depletion, UV radiation and the interaction of climate change.

Maith thú Marcel

Duckweed: From Slurry to Green Protein





Above: (Top) Speakers: Aled Jones (President, NFU Cymru) (Bottom left) Prof. Marcel Jansen (Pl Brainwaves) (Bottom right) Dr Gruffydd Lloyd Jones (Postdoc Brainwaves)

Brainwaves hosted a workshop for our stakeholders in late March that was held in the beautiful setting of the <u>National Library of Wales</u>.

Brainwaves team members Prof Marcel Jansen and Dr Gruffydd Lloyd Jones were joined on the podium by Aled Jones (President, NFU Cymru) who provided personal insight into his slurry management system and the challenges being faced by farmers.

Following a morning of interesting talks, the discussions continued whilst we visited the Botany Gardens where our outdoor experiments are up and running.

Below: Stakeholders enjoying a guided tour by Dr Dylan Gwynn Jones and Dr Gruffydd Lloyd Jones of the indoor duckweed systems at AU.



Aberystwyth Brainwaves team video on the role of Duckweed in sustainable food production systems



Brainwaves plant scientists at Aberystwyth University in Wales explain how they are addressing the challenge of delivering sustainable food production systems in the 21st century through circular economy principles – valorising a waste product and generating added value. Farm slurry is cleaned and a new resource in the form of a high protein biomass is produced, all with the help of native duckweed plants.

Watch it here.

Brainwaves in the media



February and March were busy months for our Brainwaves AU media stars, Dylan and Gruff!

The BBC Radio Wales rural, farming and environmental news programme 'Country Focus' talked to Dylan about Brainwaves and how farmers could get involved in the project (broadcast 5th February). This was followed in March with Gruff and Dylan being 'Ffermio' interviewed S4Cs for Countryside and Farming Magazine programme. The weekly programme covers a broad range of topics and news relevant to Welsh farming and the countryside.

In the interview they talked about our favourite magical plant, duckweed, and it's amazing potential. Broadcast on Monday 10th April you can watch it <u>here</u>.

If you've missed it so far put it on your 'watch list' now as back episodes are only available for 3 months from broadcast.

Brainwaves marked World Water Day 2023



Luke Ring is a 4th year honours student in the School of Biological, Earth and Environmental Sciences at University College Cork, who joined the duckweed research group and studied the question to what extent duckweed will tolerate saline water. This is an important question, as many waste streams that can potentially be used to grow duckweed contain elevated levels of salinity. As part of his project, and to emphasise the importance of clean water, Luke made this inspiring video.

Watch it here.

Celebrating St David's Day 2023



Above: Brainwaves Team at UCC celebrating Europe Day in collaboration with another Interreg funded project Ports, Past and Present.

There's nothing more Welsh than St. David's Day, the feast and celebration that falls on March 1st and commemorates the patron saint of Wales, Saint

David.

In collaboration with the <u>Ports Past and Present</u> Team we celebrated St. David's Day 2023 in style, even with homemade Welsh Cakes!

His phrase '*gwenwch y pethau bychain mewn bywyd*' which means '*Do the little things in life*' is still a well-known phrase in Wales.

Aberystwyth Brainwaves team celebrate St Patrick's Day 2023



The Welsh Brainwaves team gathered together wearing green tops, Guinness top hats and flying the Irish flag in Aberystwyth University to celebrate St Patrick's Day 2023. Legend has it that, Patrick, or Padrig in Welsh, was born into a wealthy Romano-British family around the year 386 AD. Exactly where is unknown – some say Scotland, others say Wales!!

Dydd Sant Padrig Hapus!

International Women's Day 2023

We celebrated <u>International Women's Day</u> (IWD) with a wonderful team of women who all share many commonalities but one definite one-the love of the humble duckweed plant!!



The theme of this years IWD was **#EmbraceEquity.** The campaign theme is to get the world talking about *Why equal opportunities aren't enough*.

We spoke about this theme and came across a very apt quote by american author, Jody Picoult, that we wanted to share:

'Equality is treating everyone the same. But equity is taking differences into account so everyone has a chance to succeed'

The battle to become 'Champion Duckweed'

The Science Fair held between the 14-16th March on Penglais Campus is an annual event to celebrate <u>British Science Week</u>. Aimed at school children aged 9-11 the interactive exhibits engage pupils with a range of lively science activities and quizzes. Children from around West Wales competed to become the 'Champion Duckweed' on the BRAINWAVES exhibit at <u>Aberystwyth</u> <u>Universities Science Fair</u>.



Above: Laurie and Bob enjoying a brief lull before the afternoon rush!!

UCC Plant Science students enjoy Duckweed Workshop

Brainwaves took part in an Applied Plant Biology Workshop (BL1009) for first year Plant Science students on the 23rd March 2023 in the Butler Building at University College Cork (UCC).

The workshop gave students an opportunity to learn more about research projects within the School of Biological, Environmental and Earth Sciences at UCC that are trying to tackle the "Grand Challenges" of our time.



Above: Prof Marcel Jansen demonstrating to undergraduate students

The students were clearly interested and had some insightful questions about Brainwaves' tabletop cascading re-circulatory system which was on display which demonstrates water getting cleaner and nutrients being taken up by duckweed plants as water cascades through the system resulting in clean water and generating high protein animal feed. *Below: (left and far right) Prof Marcel Jansen demonstrating tabletop re-circulatory system (middle) Dr Siobhan Higgins, Brainwaves Project Manager and Postdoctoral Researcher Dr Merve Sasmaz Kislioglu*



Chartered Institution of Wastes Management (CIWM) Resources Conference

Dr. Gruffydd Lloyd-Jones, Post Doctoral Researcher on the Brainwaves Project based at Aberystwyth University attended the Chartered Institution of Wastes Management (CIWM) Resources Conference Cymru in Cardiff on 22nd March, 2023.

Dr. Gruffydd Jones enjoyed the diverse line-up of speakers at the conference and promoted the Brainwaves Project while networking amongst the delegates.

Right: Conference delegates enjoying the presentations



Social Media



BRAINWAVES Project @BrainwavesEU

We are excited to be involved in hosting the upcoming Duckweed Workshop on June 9th 2023 in UCC. Looking forward to creating a platform of knowledge exchange with national & international expert speakers #EUIrelandWales @wefowales @SouthernAssembl @EPAResearch #DuckFeedProject

Follow our journey on Twitter <u>@BrainwavesEU</u>.

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

Project Website



09 May 2023

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Chartered Institution of Wastes Management (CIWM) Resources



20 Mer 2022 Duckweed: From Slurry to Green Protein



The battle to become the 'Champion Duckweed'

Find all your Brainwaves-related information and resources here.

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