# SciFest National Final

## SciFest@SFI Discover 2015

# *Project Abstracts*

SciFest

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## SciFest@CIT 2015

## STAND 1

**Title of Project: Maths Behind Music**

**Student**: Sarah Kate Sweeney

**School:** Scoil Mhuire Gan Smál, Blarney, Co. Cork

**Teacher Mentoring Project:** Sean Foley

**Project Category:** Physical Sciences

## ABSTRACT

This project combines my interests in music and technology. It is an investigation into the simulation of musical instrument timbres using Discrete Fourier Analysis. The original objective was to understand why different musical instruments sound different even when playing the same note. I wanted to develop a technique to allow multi-instrument musical scores to be synthesised from small amounts of reference data. This technique could be used in the gaming industry among others.

I recorded several notes on multiple instruments and analysed them using the Short Time Discrete Fourier Transform. I extracted the amplitude of the fundamental and up to sixteen harmonics from each window in each note. However, these are complex numbers. Phase shift is inaudible to the human ear, so I found the absolute value of the complex amplitudes. Using those absolute values, I re-synthesised the musical notes using a series of sine waves whose amplitude coefficients were the absolute values calculated earlier. I used interpolation to make the transitions between the windows smooth. I then synthesised a tune to demonstrate the viability of the technique as a way of generating commercial music. All of my software was written in Python and I used many standard libraries such as numpy and matplotlib.


The synthesised notes were a very good approximation to the original reference notes and it was easy to distinguish between the timbres of the different musical instruments. The tune was also a success and demonstrated how synthesised music could be used in gaming and other applications requiring musical scores.

## SciFest@AIT 2015

## STAND 2

**Title of Project:** **The Price of a Profit - A Statistical Analysis of the Effects of the GMS Charge**

**Student**: Mark Lyons

**School:** Lanesborough Community College, Lanesborough, Co. Longford

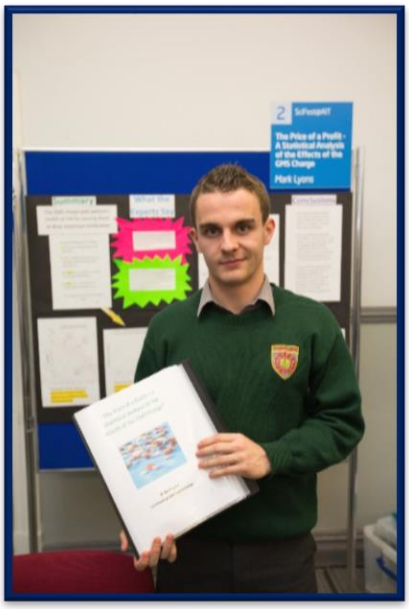
**Teacher Mentoring Project:** Michael Lyons

**Project Category:** Life Sciences

## ABSTRACT

The aim of my project was to determine whether the GMS charge caused medical card patients to stop taking prescribed medications, thus negatively impacting on patient health. The charge is €2.50/item. National and international reports on the issue, along with observations from working in my local pharmacy, indicated that the charge was causing patients to refuse to take prescribed medications.

Using the software program Gretl I analysed GMS data from my test pharmacy from 2009 onward. By running a linear regression model I found that for every €1 increase in the charge 6 fewer items were being dispensed daily. On examining the scripts in greater detail I found that when the charge was increased to €2.50/item a number of patients asked the pharmacist not to dispense medications prescribed by their doctor. When I compared the 3 months after the charge was raised to the same three months the previous year I found that there was a 644% increase in patients refusing prescribed medications.



I cross-referenced these "refused" items with a list of "essential medications" and found that over 15% of refused medications fell into this category. The majority of these were preventative inhalers.

I then contacted a number of hospitals who confirmed that, since the charge rose to €2.50/item, they've noticed an increased number of patients in hospital with poorly controlled asthma.

In conclusion, my project has shown that, at its current level, the GMS charge is causing patients to stop taking essential medications, and is thus impacting on patient health.

## SciFest@NorthWest 2015

## STAND 3

**Title of Project:** **Investigating the Ability of Egg Membrane to Absorb Carbon Dioxide and the Development of a Fan/Filter that Can Remove Carbon Dioxide from the Air**

**Students**: Laura McLaughlin, Aine Gillespie

**School:** St Mary's College, 35 Northland Road, L'Derry, Northern Ireland, BT48 0AN

**Teacher Mentoring Project:** Ann Blanking

**Project Category:** Physical Sciences

## ABSTRACT

The aim of the project was to test the ability of egg membrane to absorb carbon dioxide.

Egg membrane was exposed to carbon dioxide generated from the reaction of controlled amounts of hydrochloric acid and calcium carbonate which was dried by passing over anhydrous calcium chloride before reaching the egg membrane.

The egg membrane was weighed before and after exposure to the carbon dioxide.

The hypothesis was that if the egg membrane had gained in mass after exposure then it had absorbed carbon dioxide.

Results showed that egg membrane does absorb carbon dioxide irrespective of whether the membrane came from raw or boiled eggs. The membrane was shown to absorb 83% of the carbon dioxide it was exposed to.

The ability of egg membrane to absorb carbon dioxide was put to use in a fan/filter which can draw air through the egg membrane and remove the carbon dioxide. It is solar powered and can accept sachets of egg membrane which can be replaced after being used up.

The sachet of egg membrane has an indicator on it which shows when it needs changing and a control is incorporated that allows the speed of the fan to be regulated and control the flow of air through the egg membrane.

The fan was tested in the same way as before by finding the mass of membrane before and after exposure to dry air. Results show it absorbed carbon dioxide from the air.

This has commercial viability and concerns a real pollution problem.

## SciFest@DIT 2015

## STAND 4

**Title of Project:** **Cost Effective Sound Localisation Sensor Arrays for Autonomous Mobile Platforms**

**Student**: Oran Ó Donnabháin

**School:** Scoil Chaitríona, Mobhi Road, Glasnevin, Dublin 9

**Teacher Mentoring Project:** Brian Ó Gallachóir

**Project Category:** Technology

## ABSTRACT

Due to the growing influence of robotics in society it will become common that autonomous mobile platforms will be seen in a domestic environment. This will happen due to the development of social autonomous platforms that are intended for care purposes to help the elderly and disabled. If they are to be accepted into the homes of those in need these robots need to be able to replicate human behaviour and sensing abilities. My project aims to create an economically viable sound localisation sensor array for these autonomous mobile platforms, allowing such robots to gauge the direction of a sound and to turn in the direction of the sound source, allowing for the user to comfortably verbally communicate with their autonomous companion.

My device consists of a shell with sound sensors located around the perimeter. These sensors record sound and send the recorded information to a microcontroller located within the shell which is programmed to decipher the direction of the sound source based on the different amplitudes it receives. The shell has a cylindrical shape and is lined with sound insulating material to prevent noise from being recorded by sensors on the opposite side of the device. The microcontroller uses the sound data recorded by the sensors to calculate the angle from which the sound is coming. This information is then sent to a servomotor situated on top of the device which actuates a robotic 'head' and turns it to face the sound source.

## SciFest@ITB 2015

## STAND 5

**Title of Project: The Use of Halophytes on Marginal Coastal Land as Carbon Sinks**

**Students**: Sophie Sheahan, Adam McGrane

**School:** Skerries Community College, Skerries, Co. Dublin

**Teacher Mentoring Project:** Katie Corbett

**Project Category:** Life Sciences

## ABSTRACT

Last year we studied the seashore as part of an environmental awareness project photographing the plants in the splash zone. We found that salt-tolerant plants (halophytes) were being studied for use as biofuels. In our project we looked at their possible use in capturing carbon dioxide instead of releasing it back into the atmosphere.

We assessed soil fertility using a dye binding method with a standard curve measuring the resultant absorbance to determine the cation exchange capacity (a measure of fertility). We measured $CO_2$ and $O_2$ over 24 hours with *Beta vulgaris* (our chosen plant species) growing in different soil types. We also tested the rate of photosynthesis at different salinities. We measured the rate of composting of the plants. We tested the starch and sugar content of the plants over time as they rotted. We estimated the potential absorption of $CO_2$ by halophytes around the Irish and English coasts.

We found that the marginal soils in the splash zone are less fertile than those 100 m inland. CO2 flux is therefore lower as there is less $CO_2$ leaching from the soil. It is possible that there may be a net loss of $CO_2$ from the air in this case.

## SciFest@DkIT 2015

## STAND 6

**Title of Project: Bringing Genetics to the Masses: The Next Step in Genetic Research**

**Student**: Louis Madden

**School:** Largy College, Analore Road, Clones, Co. Monaghan

**Teacher Mentoring Project:** Sharon Magennis

**Project Category:** Life Sciences

## ABSTRACT

**Purpose**

In the twenty years since the first organism genome was mapped 4126 organisms have had their complete genome mapped: Archaea (181), Bacteria (3762) and Eukaryotes (183). The latter, Eukaryotes, have an estimated global species diversity estimated at 8.77 million species. Bacterial species are estimated to number 10 quintillion, that's 19 zeros after the 1. Although such research has benefited society by increasing our understanding of living organisms I believe we haven't used the incredible potential we have for genetic research since DNA was first sequenced in 1977. I believe the reason why is mainly due to the cost of equipment. This has limited research, particularly in developing countries where there is a critical need to carry out such research locally to address disease and food production issues. On this basis my hypothesis is: **"Genetic testing and DNA research can be carried out simply, cheaply and efficiently"**.

**Description**

Using cheap and recycled materials which in total cost me just under €150.00 I built the following laboratory equipment: vortex, centrifuge, PCR, transilluminator, gel box with power supply and gel camera. Using my equipment, I isolated and amplified chloroplast DNA using a proprietary DNA extraction kit. I had the product of my experiment sequenced.

**Data**

Using that sequence, I conducted comparative analysis as against known database sequences of the same organism to assess the efficacy of my equipment.

**Conclusion**

My results have proven my hypothesis, that it is possible to conduct genetic tests simply, cheaply and efficiently.

## SciFest@LIT 2015

## STAND 7

**Title of Project: The Handy Guide to Sign Language**

**Students**: Eoin Hayes, Adam Burke

**School:** Coláiste Chiaráin, Croom, Co. Limerick

**Teacher Mentoring Project:** Edel Farrell

**Project Category:** Technology

## ABSTRACT

Our project aimed to create a device which would aid in the learning of Irish Sign Language (ISL). We created a glove which makes use of an Arduino Nano to allow users to learn ISL from home using a computer.

Our device works by displaying videos on a computer programme to the user. The user will then mimic the gesture shown on the screen. Using flex sensors and an accelerometer, the glove will read the hand position and then send the information to the computer via a Bluetooth module on the glove. If the user correctly imitates the gesture, the program moves to the next letter. If not, they are encouraged to try again.

A flex sensor is attached to each finger of the glove. The flex sensors are then connected to a printed circuit board with the Arduino Nano microcontroller, accelerometer and Bluetooth module embedded onto it. The glove is coded using Arduino C Code, which is designed to work with the Arduino components used on the glove.

We have calibrated the device with the help of members of our local Deaf Community Centre. A number of people signed each letter. We collected a set of resistance and acceleration values for each letter. These values provided the parameters for the finger positioning of each sign.

Our project will hopefully increase the numbers of ISL signers throughout Ireland by allowing them to learn it at their own pace in the comfort of their own home.

## SciFest@GMIT 2015

## STAND 8

**Title of Project: Complexity in Chaos**

**Student**: Conall Vincent McCabe

**School:** Yeats College, College Road, Galway

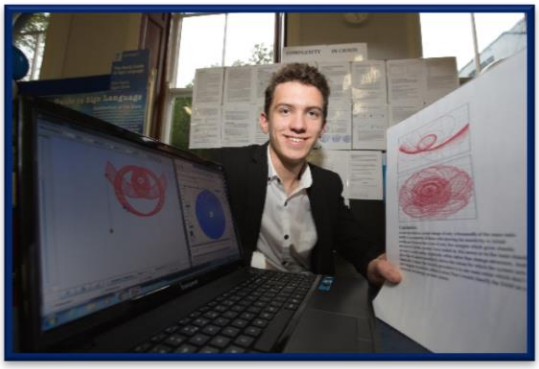
**Teacher Mentoring Project:** Corinna Mahoney

**Project Category:** Physical Sciences

## ABSTRACT

**Introduction:** Chaos theory is a mathematical field of study which states that non-linear dynamical systems that are seemingly random are actually deterministic from much simpler equations. Acknowledging that chaos theory is found in many spheres of life yet known to very few people inspired me to research and prepare this report.

**Aims/Background:** To provide a quantitative analysis of the aspects of chaos theory and to investigate the existence of chaotic motion in three mechanical systems: (i) The Double Pendulum (ii) Swinging Atwood's Machine (iii) Ball Dynamics.



**Method:** Langrangian-Hamiltonian and Newtonian mechanics were used in conjunction to derive the equations of motion of the systems. In some cases other mathematical tools such as Taylor Series expansions were utilised to fully explore the motion. Computational simulation software was used to carry out these investigations to a higher degree of accuracy.

**Results:**

- Double Pendulum: Chaotic motion is widely present in this system
- Swinging Atwood's Machine: This particular system exhibits little chaotic motion although its sensitive nature would have initially said otherwise
- Ball Dynamics: Although chaotic nature was found to be less existent in this system than in the double pendulum, the motion shows more chaotic motion than in the swinging Atwood's machine

**Conclusions:** This investigation shows that the nature of chaos is deep-rooted in a variety of seemingly linear systems that appear to be non-chaotic. This report also shows the importance of understanding a relatively unknown theory and how its implementation into other disciplines has great potential.

## SciFest@WIT 2015

## STAND 9

**Title of Project: Functional Movement Training in Young GAA Players**

**Students**: Conor Flynn, Conor Cantwell

**School:** CBS Secondary School Kilkenny, James Street, Kilkenny

**Teacher Mentoring Project:** Lisa Cosgrove

**Project Category:** Life Sciences

## ABSTRACT

Our project investigated functional movement training in young GAA players. Our aims were to assess how at risk young GAA players were to injury, to assess the knowledge of functional movement among young players and coaches and to investigate if a ten-week functional movement programme could improve players' functional movement.

We screened our school's junior hurling team using the functional movement screen. We discovered 54% of the team were at risk of injury. We decided to create a ten-week functional movement training programme.

We completed the programme with five of the junior hurling team. At the beginning of the programme 60% of the players were at risk of injury. After ten weeks none of the players were at risk of injury. This proves that functional movement can be improved by using a functional movement training programme.

We created questionnaires to assess the knowledge of functional movement among both players and coaches. The questionnaires showed an overall lack of understanding and knowledge of functional movement. The responses showed players had used functional movement training before but never in a structured manner and also that coaches had a knowledge of functional movement but weren't informing their players about it.

We addressed the lack of understanding of functional movement by creating an educational booklet and a simple functional movement test to educate players and coaches on how to improve functional movement through corrective exercises ,warm ups and cool downs.

## SciFest@ITC 2015

## STAND 10

**Title of Project: Voice Controlled Home Automation with Raspberry Pi Technology**

**Student**: Eve McGlinchey

**School:** St Leo's College, Dublin Road, Carlow

**Teacher Mentoring Project:** Julie Egan

**Project Category:** Technology

## ABSTRACT

Installation costs of typical home-automation systems range from €5,000 - €15,000. This project presents a wirelessly-networked home-automation system using Raspberry Pi technology for considerably less (≈€350).

In contrast to the many available systems, this home-automation network uses voice recognition to activate devices. Specifically, this project showcases a client-server networked system operated through Python programming using voice commands from a wireless headset. A Raspberry Pi radio and a security system with camera and door-locking mechanism are included.

The control Raspberry Pi regulates four Pi-Mote sockets which have been coded to receive vocalised instructions using Voice Command. A second Raspberry Pi allows clients to select music from a playlist and hear their chosen track played on radios within the broadcast range by simply voicing their intention. A camera module connected to the third Raspberry Pi uploads video feed to a specified webpage viewed on a monitor associated with the control Raspberry Pi.

The system has been calibrated to account for different voices and to assign interpreted words to specified commands. The range of the headset was tested (>10 m) and the broadcast range of the Pi radio was extended using an aerial and verified (>27 m). Results indicate that the headset can be used between rooms and the broadcast range extends to a car radio outside the home.

This customisable system can be installed in any home and tailored to address the needs of individuals experiencing mobility challenges. Others may simply enjoy the opportunity to be Tony Stark with their very own JARVIS for a day!

## SciFest@ITT Dublin 2015

## STAND 11

**Title of Project:** **Correlation or Coincidence? Solar Flares, Lunar Phases and Stock Market Activity**

**Student**: Claire Nichols

**School:** Sutton Park School, St Fintan's Road, Sutton, Dublin 13

**Teacher Mentoring Project:** Catherine Tattersall

**Project Category:** Physical Sciences

## ABSTRACT

Large bursts of energy from the sun have a dramatic effect on the earth, causing geomagnetic storms. This can have an effect on people's moods, causing depression, anxiety, and bad judgment.

The purpose of this project was to determine whether geomagnetic storms have an influence on people's decisions regarding the stock market. The stock market is made up of millions of individuals who make decisions in the moment based on their view of the future. A negative mood can cause people to sell stocks, driving prices lower. My strategy to avoid the market during geomagnetic storms, and the 7-day recovery period, was more profitable than remaining in the market over the same amount of time.


I analysed data on every solar storm over the last 13 years that reached a level of 6 on the planetary K-Index, which measures the actual disturbances in the earth's magnetic field. For the stock market, daily data on the S&P 500 Index was used over the same time period. Testing showed that selling the S&P 500 Index after a K-6 geomagnetic storm, and remaining out of the market for 7 days following the storm, had a hypothetical return of 210.63% between Jan 1, 2002 and December 26, 2014, compared to a hypothetical return of 81.63% for the S&P 500 Index over the same period. This strategy out-performed the buy-and-hold strategy for 10 out of the 13 years tested, in both up years and down years for the overall stock market.

I am currently testing the effect of lunar phases on market volatility, using a similar process. So far, my data suggests that the full moon causes a change in sentiment (mood swings from high to low or low to high) among the human population of traders as it is happening.

## SciFest@LIT Thurles 2015

## STAND 12

**Title of Project:** **A Statistical Analysis and Investigation of Electromagnetic Radiation Emitted by Models of Mobile Communication Devices**

**Students**: Ciara Burke, Isabel Dwyer, Clodagh Howe

**School:** Scoil Chríost Rí, Borris Rd, Portlaoise, Co. Laois

**Teacher Mentoring Project:** Breege Masterson

**Project Category:** Physical Sciences

## ABSTRACT

We felt obliged to pay heed to not only the risks involved but also possible solutions to avoiding these risks. Our inspiration stemmed from the simple fact that our mobile phones have become almost like an extra limb, constantly by our side, and to be so dependent on a device that may have negative lasting effects we believed it was crucial to further investigate.

Using a calibrated TES 593 Electrosmog Meter to measure the electromagnetic radiation emitted in $mW/m^2$ we have reached our goal of testing 200 phones. Our testing involves measuring the emissions while the phone is in an idle state, while receiving a text and while receiving a three second phone call. Our control was exhibited when the phone was turned off and no electromagnetic radiation was identified on the device. We repeated this test first right beside the device and second further away in order to investigate whether distance plays a part in the volume of radiation identified by the device/absorbed by the body. Following experimentation we used a statistical analysis package "SAS University Edition" to analyse the results and to form a conclusion. We also used the package to analyse the data of gliomas (associated with electromagnetic radiation) to the phone subscriptions in Ireland that date back to 1994.

We concluded that distance affects the results significantly and in turn developed a solution in the form of a 3D printed phone case prototype using CAD software alongside the engineering department in DIT.

## SciFest@LyIT 2015

## STAND 13

**Title of Project: Classroom or Class Doom? An In-Depth Analysis into the Effects of Using Google Classroom**

**Students**: Hannah Dominguez Mc Laughlin, Conor Gildea, Claire Barron

**School:** Crana College, Crana Road, Buncrana, Co. Donegal

**Teacher Mentoring Project:** Philip McGuinness

**Project Category:** Life Sciences

## ABSTRACT

Our project "Classroom or Class Doom?" aims to investigate the impact of Google Classroom on student/teacher attitudes and academic success. Our research was completed through various mediums. We began by contacting the Central Statistics Office for advice on how to best conduct a survey.

We conducted qualitative and quantitative surveys on a sample population of the senior student body. We interviewed a random selection from this population to gain further insight into the impact Google Classroom has had on them. Along with this we examined and compared grade averages before and after the introduction of Google Classroom in our school.

We constructed various graphs and charts to visually illustrate our findings. We found a 7% increase in grade averages since the introduction of Google Classroom. We are currently investigating if this trend continues. Some of our main findings were:

- 90.6% of students felt it had a positive impact on their learning
- 9.4% of students felt it had no impact on their learning
- 96.9% of students believed it made them feel more prepared for exams
- 3.1% of students believed it did not make them feel prepared for exams

We are currently expanding our research to examine the effect Google Classroom has on teachers' attitudes and workload. As well as this we hope to further investigate students' opinions in relation to workload and general usage of Google Classroom.

We plan to present our findings to Google and our school once our research is completed.

## SciFest@IT Sligo 2015

## STAND 14

**Title of Project: Decibels of D.V.S.**

**Students**: Anna Corcoran, Aine Kelly, Niamh McNamara

**School:** Drumshanbo Vocational School, Drumshanbo, Co. Leitrim

**Teacher Mentoring Project:** Pauline McBarron

**Project Category:** Physical Sciences

## ABSTRACT

### *Aim*

The aim of our project is to see if the sound levels in our school are within the safe limit recommended by the World Health Organisation. This limit is 80 decibels. We aim to raise awareness among the students in our school about the damage to hearing caused by listening to music at high levels on phones or iPods.

### *Our investigations*

We have downloaded an app 'sound meter' to measure the sound levels in decibels. We used a sound level meter to make sure that the readings on the app were accurate. Our school is divided up into 3 buildings. We decided to take our measurements for one week in three different buildings at 5 different times of the day. We wanted to get a good range of readings. We have measured the sound levels in practical classes, Woodwork, Metalwork, Home Economics and Science and compared them to classes such as English and Irish.

To raise awareness about the dangers of listening to high volumes for a long period of time we have put up informational posters. We have prepared a survey to ask the students of our school about their music listening habits. We hope to find out if the pupils in our school are aware of the dangers of listening to unsafe levels of sound for too long.

We have also researched about headphones and earphones, which is safer to use while listening to music on your phones.

## SciFest@IT Tralee 2015

## STAND 15

**Title of Project:** **A Statistical Analysis of Whether Segregating Males and Females for PE Will Increase Participation and Physical Activity Levels**

**Student**: Liam Passmore

**School:** John the Baptist Community School, Hospital, Co. Limerick

**Teacher Mentoring Project:** Michelle Buckley

**Project Category:** Life Sciences

## ABSTRACT

Physical activity is important to reduce the risk of heart disease, diabetes and other conditions. According to previous studies there is a decrease in participation in PE by females starting at age fifteen. The aim of this study was to ascertain if PE classes in co-educational schools were undertaken as single-sex classes would participation increase. Also, I investigated if the sexes enjoyed participating more. Online surveys were used to investigate this in secondary school students of all ages and both sexes. I studied attitudes towards the subject of PE, single-sex or co-ed, and which areas of PE were favoured together or apart. I studied many journals using Google Scholar. I distributed the link of the survey to students from schools locally and I got approximately 325 students to respond. I ensured that there was an equal spread of males and female students from all years and ages. I concluded from analysing my data that females were more likely to avoid participation in PE than males. This is due to perception by both sexes of physical capabilities. I also found that students would rather play contact sports separately but would rather play non-contact sports mixed as they would find it more enjoyable. It has been proposed by the Irish government in recent times that PE should become an exam subject. I agree with this initiative but I believe my findings are significant to develop the criteria for the students participating in this exam and to outline an effective curriculum.

# *SEAI INESPO Award*

# *Project Abstracts*

## SciFest@IT Tralee 2015

## STAND 16

**Title of Project:** **Fuinnimh Tonnta Gan Creimniú Cósta (Reducing Costal Erosion While Generating Electricity from Wave Energy)**

**Students**: Janine Ní Chonchúir, Ursula Ní Mhochóir, Lorraine De Nais

**School:** Gaelcholáiste Chiarraí, Tobar Mhaigh Dor, Trá Lí, Co. Chiarraí

**Teacher Mentoring Project:** Elaine Ní Dheargáin

## ABSTRACT

Our project was to investigate the reduction of coastal erosion while generating electricity.

**Our proposal was**:

A. To trip the wave and dissipate its mechanical energy before it reaches the shoreline (and causes erosion) by installing floating breakwaters close to the shore and
B. To harness the dissipated mechanical energy to generate electricity.

**Our investigations concluded:**

1. Large floating breakwaters are not feasible because of the amount of mechanical energy released per metre by a breaking wave.
2. Small floating breakwaters are feasible from a survival point of view but to be effective against erosion they must be located close inshore.
3. To harness the incoming waves, but not be affected by the retreating wave as it goes back out underneath, the floating breakwaters need to be in water that is twice as deep as the height of the incoming wave.
4. The mechanical energy released by the wave should be transferred onshore, stored, and electrical energy produced there.
5. We propose the use of dielectric polymers to store and generate electricity in the form of piezoelectricity.

We estimate that 100 one-metre floating breakwaters could generate 3500MW per annum, roughly 70% of the power actually generated by a wind turbine - enough for the electrical needs of about 580 homes or the total energy needs of about 130 households each year.

We conclude that the generation of cheap, clean electricity from wave energy is viable but that a floating breakwater has limited viability for the prevention of coastal erosion.

## SciFest@ITB 2015

## STAND 17

**Title of Project: The Automation of Light Intensity for Energy Conservation**

**Students**: Aisling Paterson, Niamh Wilson

**School:** Dominican College, 204 Griffith Avenue, Dublin 9

**Teacher Mentoring Project:** Mick Moriarty

## ABSTRACT

Our aim in this project was to create an energy efficient circuit which, when implemented in buildings, would reduce the energy consumption. This is because less energy would be needed to power the lights during the brighter hours of the day.

Essentially, by calculating the value for the light intensity already present in the room and subtracting it from the intended overall light intensity, we can find out the light necessary to maintain the constant light environment in the room.

Then by emitting that amount of light we can produce the intended light intensity in the room. However, the LED works on a scale from 0 - 255 so we must map our initial scale to correspond to the LED scale. We did this by using Energia's map function. Finally we set the value of the LED to this value. This code loops constantly and we delay by 10 milliseconds every time to ensure the program runs efficiently.

After reviewing our results we can conclude that by using our concept in your home you could save electricity and money. From our results you can see that when the LED is only required to light at 50% brightness it uses half as much power compared to when it is lighting at 100% brightness. It is also clear that it is producing less light in bright conditions and more light in dim conditions as seen by the readings on the lux meter – thereby saving money.

## SciFest@LIT 2015

## STAND 18

**Title of Project:** **An Investigation into the Use of *Fucus serratus* and *Fucus vesiculosis* as a Raw Material for Thermal Energy Production**

**Students:** Aoibhe Cronin, Ciara McInerney

**School:** Scoil Mhuire, Ennistymon, Co. Clare

**Teacher Mentoring Project:** Sue-Ann Sheridan

## ABSTRACT

The title of our project is "An investigation into the potential usage of *Fucus vesiculosus* and *Fucus serratus* as a raw material for thermal energy use." *Fucus vesiculosus* and *Fucus serratus* are the two seaweeds which are most common in our local area of Lahinch, Co. Clare. We set out to investigate its potential as a renewable energy source.

To investigate the calorific value of our seaweed samples, our samples had to be dried first which allowed us to determine moisture content. Bomb calorimetry was then carried out using a Parr 6200 calorimeter. We also found the pH and the salinity of the seawater in Lahinch.

We carried out a quantitative study of our two seaweeds, namely the percentage frequency and percentage cover on a 2.5 $m^2$ section of Lahinch Beach.

**General Results and Conclusions:**

1. The calorific value of each of the seaweeds ranged from 11.3566 MJ/kg to 12.3156 MJ/kg for *Fucus vesiculosus* and from 11.7306 MJ/kg to 13.188 MJ/kg for *Fucus serratus. Chondrus crispus* had a calorific value of 11.5264 MJ/kg.
2. The percentage cover of *Fucus serratus* is 13.1 % and the percentage cover of Fucus vesiculosus is 12%.
3. The pH of the seawater came in as neutral with a pH of 7. The salinity made up 5.26% of the seawater.

**Conclusion:**

The average calorific value of *Fucus vesiculosus was* 11.842 MJ/kg and the average calorific value for *Fucus serratus* was 12.6592 MJ/kg. The calorific value of wood comes in at 14 MJ/kg. This shows that seaweed could be used as a fuel source as its calorific value (or burning properties) is similar to the calorific value of wood.

## SciFest@LIT Thurles 2015

## STAND 19

**Title of Project: It's an Ill Wind that Blows No Good!**

**Students:** Lorcan Tuohy

**School:** Borrisokane Community College, Borrisokane, Co. Tipperary

**Teacher Mentoring Project:** Niamh O'Sullivan

## ABSTRACT

I investigated wind power as Ireland is an ideal location for windfarms due to our geographical position; the consistency and average strength of the wind speed; our terrain makes it easy to construct onshore windfarms and our coast also has good windspeeds for offshore windfarms.

My initial investigation showed the relationship between the speed of the wind and the power generated by wind turbines. I built a model wind turbine and used a fan to produce wind. I recorded the power generated by the turbine at different speeds. During this investigation I observed that the length of the blade impacted on the potential to generate power. Based on this I tested my hypothesis that the length of the blade impacts on the power generated by using different length blades on the model wind turbine and recording the power generated at a range of wind speeds. I found that the size of the blade impacts on the power generated and that the most efficient blade was not the longest as they had significant drag which means that they could not pick up momentum.

I did some further research into this and I found out that other factors including air density and the power coefficient impact on the power generated. I became aware of Betz' Law (½ ρAv3 Cp) which relates to the power coefficient of a wind turbine. The power coefficient was discovered by Betz in 1919 and he found that a wind turbine could not convert more than 59.3% of the kinetic energy of the wind. This is a significant factor in deciding on the type of turbine used as some turbine designs only convert 15% of the kinetic energy.

## SciFest@CIT 2015

## STAND 20

**Title of Project: An Investigation into the Effect of LEDs on Plant Growth**

**Students:** Tom O' Donovan, Robbie Matthews, James Hayes

**School:** Clonakilty Community College, Clonakilty, Co. Cork

**Teacher Mentoring Project:** Patrick O'Keeffe

## ABSTRACT

We set out to discover the difference in rates of growth of plants and herbage produced using an LED and non-LED bulb.

We intended to modify a propagator to suit growing conditions and artificially induce photosynthesis. We wanted to find a more energy efficient way of growing plants artificially to protect the environment and possibly help reduce global warming.

Firstly, we grew cress seeds in a small plant propagator kept in the dark. We exposed one propagator to LED light and another to normal incandescent light. We measured the mass of each set of seeds after one week. We scaled up the size of the experiment using a modified plant propagator. We built this propagator by attaching strips of black bags (no other light affected the plants) to the outside of a standard portable greenhouse.

We purchased a Duracell 6W LED bulb (equal to our 40W incandescent bulb).

We planted our seeds (5600 barley, grass, cress and wheat) in trays in the greenhouse.

We gave each seed Sach's horticulture solution to provide the necessary nutrients for germination. We measured temperature and humidity using a thermo hygrometer.

Three weeks later, we harvested our plants and gathered results such as height, weight and percentage difference between bulbs.

Some observations were:
Barley: The average height of the plants under the LED bulb was 19.7% taller and 25.3% more mass than the incandescent bulb.
Grass: The average mass of the plants that the LED bulbs helped to grow were 125.4% heavier than the incandescent bulb. More herbage was produced using the LED bulb.

## SciFest@DIT 2015

## STAND 21

**Title of Project:** **An Investigation of the Potential of Pine Needles as a New Alternative Biodiesel Source**

**Student:** Luc de Barra

**School:** Coláiste Raithín, Bóthar Florence, Bré, Co. Chill Mhantáin

**Teacher Mentoring Project:** Lís Ní Chíobháin

## ABSTRACT

This project investigated the viability of native Scots Pine needles as a biodiesel feedstock.

The hypothesis was that pine needle oil has significant untapped potential in biodiesel production. Experiments were administered on a large quantity of pine needles. Two methods of extracting oil from pine needles were tested and compared, i.e. compression and steam distillation. Pine needle oil was processed using transesterification and two methods thereof, i.e. cold transesterification and hot transesterification, were compared. Calorimetry was carried out to measure the Gross Calorific Value of the processed oil, compared to diesel and rapeseed oil.

In addition, for comparison purposes, I tested the possibility of bioethanol production through the fermentation of pine needles. At this point the transesterified sample was sent to an independent outside laboratory to measure the Gross Calorific Value, viscosity, flash point, suspended water content, density and Fatty Acid Methyl Esters (FAME), in order to allow me to conclusively establish whether my product met the criteria for biodiesel.

My results showed compression to be the most efficient method of extraction, although yields were low. Fermentation yielded no bio-ethanol. Transesterification produced a product which met the limits of biodiesel in all areas except viscosity and FAME content. The Gross Calorific Value was particularly encouraging. This highlights that, despite pine needles having herein proven to be unsuitable feedstock for the production of biodiesel, they hold clear potential in the bioenergy sector.

Implications and recommendations for further research are discussed.

# *Boston Scientific Medical Devices Award*

# *Project Abstracts*

## SciFest@DIT 2015

## STAND 22

**Title of Project: A Medical Device to Assist Doctors Finding Veins**

**Student**: Moritz Ziewer

**School:** Sutton Park School, St Fintan's Road, Sutton, Dublin 13

**Teacher Mentoring Project:** Catherine Tattersall

## ABSTRACT

My project is to build a medical device to help doctors find veins. Through interviewing nurses and phlebotomists at the hospital, I found out that doctors often have difficulties in finding veins in children, overweight people and people who have a lot of IV treatment.

As a first step of building my medical device, I wanted to discover what colour of light made it easiest to see veins clearly. I found out that red, white, violet, green and blue lights could work. In order to test these different lights, I painted the inside of a box black, which has LED lights that could be switched to different colours (red, violet, blue and white) and asked a number of students with which colour they saw the veins most clearly. They chose red and white, but said that the white light was better than the red light when it was placed directly at the skin (the room had to be dark for the lights to work).
With this initial feedback, I decided to build a first prototype consisting of a tube, four white LED lights that press against the skin, and a 'sunlight blocker' to reduce the sunlight falling into the tube. The tight tube of the prototype also prevents the patient's arm from moving.

During further testing, I found out that you can see the veins better when you looked through the screen of a camera. Therefore, using this information I built my improved medical device.

## SciFest@CIT 2015

## STAND 23

**Title of Project: A Smoke Detector for the Deaf or Hard of Hearing**

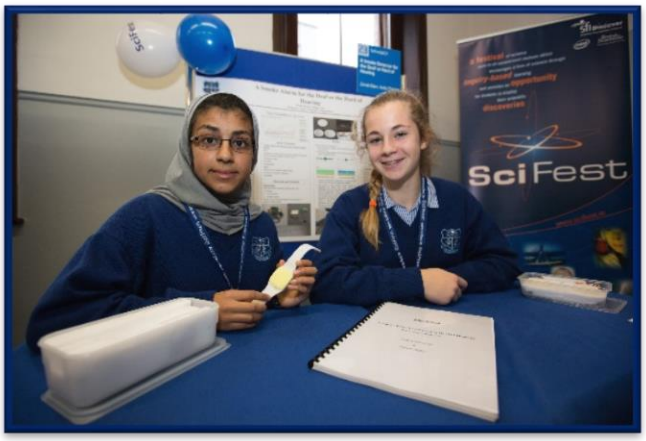
**Students**: Zainab Baker, Aoife O'Driscoll

**School:** Mount Mercy College, Model Farm Road, Cork

**Teacher Mentoring Project:** Aaron O'Sullivan

## ABSTRACT

The project aim was to design an affordable prototype of a Personal Alert System for the deaf or auditory impaired that responded to standard audible smoke alarms in general use. A prototype of a watch-like device was designed to be worn on the wrist that alerts the wearer by vibrating repeatedly when triggered by an audible smoke alarm.




An initial device was constructed which consisted of a rechargeable battery, circuit board with receiver and vibrator motor. This initial device was triggered by Bluetooth technology. Using Python Software the frequency of a routine smoke alarm was established. A band-pass filter was then applied to a recording of a smoke alarm with considerable ambient noise. It was evident from the test results that it was possible to use the technology to isolate the frequency of a smoke alarm even with background noise. Evidence that the software worked in these test conditions confirmed that the device has the potential to work in an everyday environment if a smoke alarm is triggered. We tested the device's battery and established that it had a standby battery life in excess of 60 hours when hourly triggered by the MetaWear Application. Even though many available products have more functions than our prototype, our device, when fully developed, will be very portable and convenient. This will allow the hearing impaired more freedom in their daily lives as it does not require any specialised system to function.

## SciFest@DkIT 2015

## STAND 24

**Title of Project:** **Harnessing Patient Information to Mitigate Risks Associated with Stroke Treatment**

**Student**: Cillian Gartlan

**School:** Patrician High School, Carrickmacross, Co. Monaghan

**Teacher Mentoring Project:** John O'Rourke

## ABSTRACT

**Hypothesis**

In my project I studied stroke, in particular its causes and treatments. I noticed that there are many risks involved in treating stroke due to the two types of stroke being so different and how the time delays associated with lowering these risks impacts on the patient's chances of survival. This led me to an idea on how to help mitigate the many risks associated with stroke treatment, the 'Ictus' data device.

**Methods**

I began to learn about stroke through reading relevant clinical papers, researching stroke websites and through dialogue with researchers in Ireland and Germany. I studied the diagnosis of stroke, which includes the use of stroke scales and CT scanners, as well as the treatment options for both types of stroke and the risks that they carry.

**Analysis**


My research suggested to me that many of the risks associated with stroke treatments stem from the fact that there is a lack of patient information, which leads to delays and wasted time in finding this information. This in turn leads to higher risks, even when the correct treatment is chosen, due to the damage being caused by the stroke. To tackle this problem, I devised the 'Ictus', a wearable data device that stores medical information for stroke victims.

**Conclusion**

I believe that the 'Ictus' data device can mitigate many of the risks of stroke treatment by providing doctors with the patient's medical history, including CT-scans, previous stroke types and details of any medication the patient is currently taking.

## SciFest@ITB 2015

## STAND 25

**Title of Project:** **Challenges for Blind People in Identifying Euro Notes: Exploring One Cost Effective Solution**

**Student:** Eleanor Murchan

**School:** Loreto Secondary School, St Michael's, Navan, Co. Meath

**Teacher Mentoring Project:** Helena Smyth

## ABSTRACT

The purpose of my project was to develop and evaluate *NoteCheck* - a small wallet-like structure which allows a visually impaired person to correctly identify the most common euro notes. Laminated coloured card was used to make *NoteCheck* and the numbers 5, 10, 20 and 50 were embossed onto it in print and braille. I hypothesised that people using *NoteCheck* would identify notes more accurately and easily than when using other methods. If proven, *NoteCheck* could be of significant benefit to blind and visually impaired people.

Initial investigation using the internet showed that there is no one simple reliable way for people with visual impairment to identify euro notes. When creating *NoteCheck*, I arranged to interview two people familiar with visual impairment; a community resource worker with the National Council for the Blind in Ireland (NCBI) and a researcher in visual impairment in Trinity College Dublin. They gave me valuable knowledge on existing methods, the flaws with these methods, and made recommendations on how to improve *NoteCheck.*

Testing of *NoteCheck* involved 77 blindfolded sighted students in my school identifying notes by touch only and then using *NoteCheck*. Students using *NoteCheck* had a 97% success rate in identifying 3 notes correctly. Testing with a small number of NCBI service users resulted in a 100% success rate, in addition to much positive feedback.

From the statistical and interview results I concluded that the hypothesis was correct: Visually impaired people using *NoteCheck* correctly identified euro notes more accurately than when using other methods.

## SciFest@IT Tralee 2015

## STAND 26

**Title of Project:** **Virtual Visual - An App that Guides a Visually Impaired Person around an Unfamiliar Building**

**Students:** Timothy McGrath, Donal Brennan

**School:** Killorglin Community College, Langford Street, Killorglin, Co. Kerry

**Teacher Mentoring Project:** Donal O'Reilly

## ABSTRACT

This project is based on an app that we developed which will communicate with Near Field Communication (NFC) tags to help guide a visually impaired person around an unfamiliar building. NFC tags can be placed on or near the doors of the building so that when a visually impaired person comes to the door they can utilise it with our app 'Virtual Visual' using their smartphone. When they touch their phone off the NFC tag 'Virtual Visual' will deliver an audio message on key aspects of the room, its activities, its layout, obstacles and dangers.

This project has the potential to dramatically change the lives of over 14,000 blind and visually impaired people in Ireland or over 285 million people worldwide who are visually impaired, 39 million of which have no vision at all. The inspiration for our project came from our classmate Seamus who is visually impaired himself. We saw him struggle with everyday tasks that we take for granted and thought that there must have been some way to help him using technology. He already does use a lot of technology but that can be very cumbersome and we thought that the technology in his pocket (his smartphone) should be able to help him more than it currently does. Going forward with our project Virtual Visual we want to make a website that would allow a business or organisation to produce an app themselves that would connect with NFC tags.

## SciFest@ITT Dublin 2015

## STAND 27

**Title of Project: A Medical Device to Treat Hand Burns**

**Student:** Cherie O'Keeffe, Jonathan Andrews, David Joyce

**School:** Sutton Park School, St Fintan's Road, Sutton, Dublin 13

**Teacher Mentoring Project:** Catherine Tattersall

## ABSTRACT

Our project is a medical aid for the treatment of hand burns that might be encountered by busy chefs (since twenty minutes is recommended for cooling the burned hand by immersing in cold water.) The device uses the effects of an endothermic chemical reaction. An endothermic chemical reaction is one that absorbs heat energy from its surroundings.

We decided to test various ratios of sodium hydrogen carbonate and citric acid. These are two relatively safe chemicals. Our initial testing involved trying different ratios with water and measuring the coldest temperature reached for the longest time. Our calculations were based on the chemical equation for the reaction and then using the exact ratio of moles. We used a data logger attached to GoLink software to record the temperature changes over a 20 minute time period and we found that the greatest temperature fall lasting for the longest time was achieved with a ratio of 1.6:1 of sodium hydrogen carbonate to citric acid. This precisely matched the ratio of moles in the chemical equation. The glove design is a silicone outer layer with the chemical mixture inserted into an inner plastic bag. This has a plastic tube with a valve through which water is injected with a syringe. An inner layer of gauze prevents the skin having direct contact with the cold bag. We similarly designed a smaller plaster version.


Our device could be of great help to busy chefs in treating minor burns.