

# SCIFEST 2017

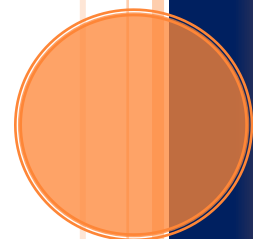
## NATIONAL FINAL

*Project Abstracts*



[www.scifest.ie](http://www.scifest.ie)

November 2017



## SciFest@IT Tralee 2017 STAND 1

**Title of Project:** Tractor Safe Lock

**Student:** Jack Nagle

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

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

**Project Category:** Technology

### ABSTRACT

My inspiration for this project came from witnessing my Grandad trapped under his tractor. When he got off his tractor rushing to put an implement on the back, he forgot to pull the handbrake. The tractor then rolled back crushing him under the tractor. Luckily his call was heard and he was rescued from underneath the tractor.

I started researching from that point and found out most farmers do not pull the handbrake when leaving their tractors. I was shocked to find that there is no device on the market that can be fitted to tractors to help stop the accidents that are occurring each and every day and most importantly to stop the deaths, which are extremely high and shocking.

The device I have created operates when the vehicle is in neutral. It sends a power signal to the first circuit and when there is no weight present on the seat sensor it sends a power signal to the second circuit/relay. When the first circuit receives power it then sends a power signal to the second circuit/relay which then sends a power signal to the control valve.

The control valve then operates the direction of the actuator which engages the handbrake. When the driver sits back into the seat, the actuator releases. The operator then has to release the handbrake manually.



## SciFest@LIT Thurles 2017 STAND 2

**Title of Project:** When in Doubt Swing it Out!

**Students:** Christine Delaney, Seamus Ryan, Kate Madden

**School:** St. Joseph's College, Pallas, Borrisoleigh, Co. Tipperary

**Teacher Mentoring Project:** Mary Gorey

**Project Category:** Technology

### ABSTRACT

Our hypothesis was that we could develop a device that when used would develop muscle memory in the user to help golfers' backswing and putting.

We needed to obtain the optimal angle for a backswing in golf to give our device its target.

To improve our initial accuracy and reliability in calculating the optimal swing angle, which we had obtained from photos of famous golfers, we used Organic Motion sensors in the sports lab in LIT Thurles. This allowed us to calculate angles from a 3D simulation which gave us the ideal length of a golf backswing for configuration.

In swing mode, we developed three tilt switches and a buzzer that are positioned and programmed in such a way that you know how far back you are in your backswing. The

three tilt switches constantly tell the microcontroller if they are "HIGH" or "LOW" alerting the user. Putt mode uses an accelerometer as well as the buzzer; only one axis is used on the accelerometer, the x axis.



We trialled our device on a sample size of 174 people. Our results showed that for the backswing 100% of participants got within the optimum angle range (120°-124°) upon retesting. For putting mode there was a mean improvement of 17.5%.

A development to our device would be to use the accelerometer in both swing and putt mode. To use it in swing mode we would use all three of its axes and have the microcontroller constantly monitoring their values.

## SciFest@DIT 2017 STAND 3

**Title of Project:** Protecting Turbofans from Foreign Object Damage

**Student:** Omar Salem

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

**Teacher Mentoring Project:** Catherine Tattersall

**Project Category:** Technology

### ABSTRACT

At any given moment there are over 1 million people in the sky travelling across the planet. Air travel has become so vital for today's logistics and economy. However, one accident can cost millions in damage, cause airline stocks to plummet, ground entire fleets and ultimately result in the loss of life.

One of the primary contributors to air traffic incidents is foreign object debris. Foreign object damage occurs when any alien entities such as birds, rocks, screws and other debris enter the engine of an aircraft. The most common time for this to happen is during or shortly after take-off. Highly publicised incidents caused by FOD include Air France Flight 4590 Concorde crash in 2000 and US Airways Flight 1549 which landed in the Hudson River in 2009.

Various economic studies on the effects of FOD reveal that it costs airlines over 13 billion USD in repairs, new parts, cancelled flights, delays, maintenance and labour. This could also be viewed as 26 USD per flight. A solution that reduces or eliminates this danger and expenditure is highly needed in the aviation industry for it to continue to grow and remain safe.

I have developed an autonomous system that can be easily retrofitted to any modern jet engine on any modern subsonic aircraft. The system identifies foreign object debris about to enter the engine and prevents it from doing so with speed and precision. The most important design consideration, which has been implemented, is that it does this without compromising the high fuel-efficiency of modern aircraft. Using DCU's new computational design and simulation studio, I have designed the system and tested it to see how it behaves aerodynamically and mechanically. I have constructed the prototype using a micro controller and a high-end 3D printer.



## SCIFEST@DCU 2017 STAND 4

**Title of Project:** What Environment Do Lichens Prefer?

**Students:** Ella Kavanagh, Niamh Scanlon

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

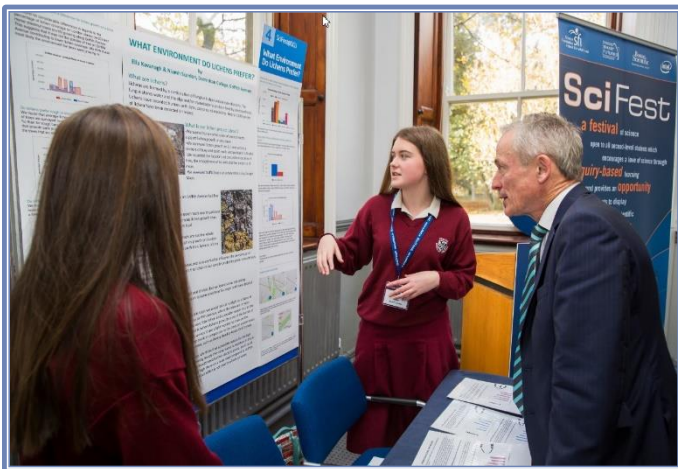
**Teacher Mentoring Project:** Catherine Corry

**Project Category:** Life Sciences

### ABSTRACT

We measured lichen growth on 61 trees and surveyed the location and circumference of each tree, the smoothness of its bark, the presence of moss and lichen and the traffic levels in the area.

We found a wide range of average lichen growth on trees, from approximately 7% along Griffith Avenue to approximately 81% on Bantry Road in Drumcondra. Some lichens are



not surprised to see low lichen growth on Griffith Avenue as it is a busy road, and high lichen growth on Bantry Road as it is quiet. But by analysing our data we came to the conclusion that traffic is not always a deciding factor in the environment that determines whether lichens 'like' to grow there. In particular we found that lichen growth was high in trees on a busy road next to the Grand Canal in Dublin 2.

Overall we think that several factors may contribute to lichen growth on the trees we surveyed, including light and moisture, and we suggest future research that could answer these questions and help us to plan future improvements for environments to support lichen growth on city trees.

## SciFest@ITC 2017

### STAND 5

**Title of Project:** Glogos

**Student:** Seán Byrne

**School:** Avondale Community College, Avondale, Co. Wicklow

**Teacher Mentoring Project:** Aoife Sullivan

**Project Category:** Technology

### ABSTRACT

My project investigated different methods of making safety clothing 'glow', or emit its own light, to improve safety by making the wearer more visible.

The main aim of my project was:

- To investigate alternative methods of making hi-vis clothing 'glow' to improve wearer safety

The methods used included:

- To investigate whether hi-vis jackets can be seen in low-light conditions
- To design a circuit to make hi-vis clothing emit its own light
- To compare the effectiveness of different light emitting materials, such as electroluminescence (EL), fibre optic fabric, and photoluminescent phosphors



My main findings are as follows:

- Hi-vis jackets are only visible when light is shining directly on them
- By incorporating self-illuminating materials into the hi-vis jackets visibility is significantly improved
- Electroluminescent tape is more visible than fibre optic fabric
- The phosphorescent material (phosphor), strontium aluminate is a cheap, effective method to make hi-vis clothing glow to improve the wearer's safety

My key recommendations are:

- Road safety for pedestrians and cyclists can be significantly improved by incorporating self-illuminating materials into clothing
- Self-illuminating materials should also be used to improve the effectiveness of hi-vis clothing used in industry, and to improve workplace safety
- A range of self-illuminating Glogos products can be developed to provide personal safety solutions for road users and for workers in industry

Future work includes:

- Develop a range of safety products, e.g. Glo-Shoes
- Develop products aimed at fashion industry, e.g. t-shirts with brand logos/slogans that glow
- Bring products to market

## SciFest@ITS 2017 STAND 6

**Title of Project:** Bike Collision Prevention Sensor

**Student:** Ben Maloney

**School:** St. Murdach's College, Sligo Road, Ballina, Co. Mayo

**Teacher Mentoring Project:** Anne-Marie Whelan

**Project Category:** Technology

### ABSTRACT

Focusing on bicycle safety, I have designed a device that will alert the cyclist of any approaching vehicles within a 40-metre range whilst also alerting the driver of the cyclist's presence.

I have achieved this by using a LIDAR sensor (The Lidar Lite v3) to detect the vehicle; bright 10 millimetre LED lights (fixed beneath the saddle) that flash at the motorist to alert them of the cyclist's presence; and another LED (on the handlebars) that also flashes to alert the cyclist of the approaching vehicle, giving them ample time to react, if necessary.

Unlike the standard flashing red lights used on the back of many bicycles, I decided to incorporate a sensor so that the motorist will see a constant white flashing light that will increase in frequency as their vehicle approaches the cyclist. However, the light on the handlebars to alert the cyclist will only flash when the vehicle has entered into the 40-metre range of the sensor.



The main reason that I have selected this project is because The Road Safety Authority (RSA) statistics have shown a sharp increase in accidents for cyclists on Ireland's roads in the last number of years.

This device will leave cyclists in a much safer position as they will now be aware of any approaching vehicles before the vehicle has had a chance to enter into a dangerous range of the cyclist.

## SciFest@LIT Thurles 2017 STAND 7

**Title of Project:** Solar Sleeve

**Student:** Joseph O'Donoghue

**School:** St. Joseph's College, Borrisoleigh, Co. Tipperary

**Teacher Mentoring Project:** Mary Gorey

**Project Category:** Physical Sciences

### ABSTRACT

I came up with my idea, Solar Sleeve, whilst listening to my dad complaining about the lack of wind one day which would mean our two wind turbines would not be generating much power.

Currently it takes a long time to get a grid connection. In our case, we waited nearly 9 years. It is a very slow process in Ireland. Most grid connections are only at 30% capacity of what they could add to the national grid. I investigated if I could add extra power to these grid connections, quickly and with a relatively low cost. I decided that solar energy would be a good area to investigate.



Adding photovoltaic cells to towers of turbines would be an example of sustainable development using pre-existing infrastructure. In Ireland alone 228 farms, with each containing many turbines, could benefit from adding solar panels to the turbines according to my results.

140 m<sup>2</sup> of photovoltaic cells (without installation) in Ireland would cost approximately €380 from initial research based on a low-quality cell. Top of the range cells cost €16,000 for the area needed per turbine and would give a much larger power output.

The 'Solar Sleeve' has the potential to produce €51,000 a year minimum, per turbine, based on my readings, using low efficient PV cells, with average results from readings in both the winter and summer. One turbine, working for 1608 hours a year would produce 1,050 MWh. That is enough to power 318 homes.

## SCIFEST@DKIT 2017 STAND 8

**Title of Project:** Park and Stride – The Hidden Hazards

**Students:** Dearbhla McCourt, Ruth Clarke

**School:** St. Vincent's Secondary School, Seatown Place, Dundalk, Co. Louth

**Teacher Mentoring Project:** John White

**Project Category:** Life Sciences

### ABSTRACT

#### Introduction

According to the Global Burden of Disease Study, air pollution causes more deaths than malnutrition, obesity, alcohol, drug abuse, and unsafe sex. We both attend school in Dundalk, a busy town, and were keen to investigate the levels of emissions from cars in this area.

#### Method

We detected elevated emissions (particulate matter, NO<sub>x</sub> gases and CO) using sensors we built and coded, outside primary schools located in Dundalk at peak traffic times (i.e. when parents are dropping their children to school and picking them up again). Pupils' height and number of passing cars were variables investigated in relation to increased levels of gas exposure.



We looked at 3rd – 6th class pupils as our target group and adjusted our sensors which were attached to an Arduino Uno board to the mean of their average height (nose position) (122.5 cm). We also used a separate identical sensor at the mean of the average height of an adult man and woman as a comparison (172 cm). We used these sensors to simultaneously record the elevated emissions from car exhausts that children are exposed to compared to adults along 'Park and Stride' routes.

#### Conclusions

Our investigative studies to date show that on average children are exposed to greater emission levels than adults. This is worrying for the health of children and warrants further investigation internationally because of the height (they are closer to ground level ozone and other toxic car exhaust emissions) and physiology of children (developing lungs). The EPA and WHO should take into account that lower dosages can have greater health implications on children and the under-12 population.

## SciFest@GMIT 2017

### STAND 9

**Title of Project:** Fire Ashes – An Undervalued Nutrient

**Students:** Shannon McHugh, Ciara Keaveney

**School:** Glenamaddy Community School, Glenamaddy, Co. Galway

**Teacher Mentoring Project:** Deirdre Hardiman

**Project Category:** Life Sciences

## ABSTRACT

### Aim

We aimed to show how turf and wood ashes have a lot of benefits by our research and our experiments. Our tests used comparisons of ashes versus artificial fertiliser. We aimed to educate people on the beneficial uses of wood and peat ashes.

### Our tests

- We examined the difference in the growth in grass – between the different types of ashes (wood, peat and a combination of both) – and comparing these with expensive and cheap artificial fertilisers.
- We investigated the different nutrients in ashes and their purposes.
- We grew ridges of onions with ashes mixed throughout the soil and ridges without.
- We grew cabbage and used ashes around a ridge instead of slug pellets to investigate if ashes can be used as a slug repellent.
- We investigated if the pH of soils could be raised by using ashes as a substitute for lime.
- We carried out a taste testing of onions grown with and without ashes.
- We contacted bin companies and horticulture centres to get their ideas and opinions.

### Results and Conclusions

Through our experiments we showed how grass and crops grow better with ashes and how this product, which has lots of nutrients with valuable applications, is being wasted in Ireland.

We discovered that there is a difference in taste in onions grown with and without ashes. We also found that slugs cannot pass through the ashes, so ashes can be used as a slug repellent.



We would like to see these ashes being dropped off at collection points, from where farmers and horticulture centres could collect and reuse them in an environmentally friendly way. This current research shows that this project has commercial viability and addresses a very real pollution problem.

## SciFest@WIT 2017 STAND 10

**Title of Project:** Prevention of Further Concussions and Head Trauma in Rugby  
due to Early Detection

**Students:** Eimear Power, Holly Meaney

**School:** Our Lady of Mercy Secondary School, Ozanam Street, Waterford City

**Teacher Mentoring Project:** Rosario Burke

**Project Category:** Technology

### ABSTRACT

Our aim was to provide a piece of equipment that can limit the number of head injuries a rugby player sustains in a game. We connected a webserver to an Arduino Uno Wifi and Arduino Nine Axes Motion Shield (micro-controller, accelerometer and gyroscope). The webserver is programmed to read all the data off the Arduino so coaches and medical staff can read the information from the webserver and detect whether the player has received a serious head injury.

The coaches and medical staff can then make a quick decision to remove the player from the field based on the figures displayed on the webserver. We carried out a number of experiments to test the reliability and accuracy of each attribute of our project. Each experiment we carried out was tailored specifically to testing each element of our project.



We also investigated the ongoing problem that is concussion. We compared rugby statistics from games just after rugby turned professional in 1995 to the modern game. We believe that our project can be used in a wide variety of contact sports not just rugby. We believe this project can contribute to science and hopefully make a difference!

## SCIFEST@DIT 2017 STAND 11

**Title of Project:** The Truth about Cleaning Makeup Brushes

**Student:** Isobel Moloney

**School:** St. Andrew's College, Booterstown Avenue, Blackrock, Co. Dublin

**Teacher Mentoring Project:** Laura Brogan

**Project Category:** Life Sciences

### ABSTRACT

My project is to see the effectiveness of different commercial cleansers versus the effectiveness of my own natural antibacterial cleanser on the removal of bacteria and cleansing of makeup brushes. I tested different commercial cleansers and then created my own cleansers based on the data I gathered from the results.

I created five different formulations of this cleanser using the same base soap but varying the amount of the natural antibacterial. The antibacterial chosen was tea tree oil. I then tested my cleansers to see the difference between mine and the commercial ones. I used different identification methods to help me identify different bacteria. I used Gram staining, KOH string test, Catalase test and colony counting to get my results.



The results I got from commercial cleansers was very unsatisfactory but I was extremely pleased with the results of my own natural antibacterial cleanser.

## SciFest@ITC 2017

### STAND 12

#### **Title of Project: Measuring Radon Awareness**

**Students:** Kate Kirwan, Ciara Carroll, Niamh O'Dowd

**School:** FCJ Secondary School, Bunclody, Co. Wexford

**Teacher Mentoring Project:** Catherine Doyle

**Project Category:** Life Sciences

## ABSTRACT

Our school, FCJ Bunclody, is located in a high-risk radon area. Radon is a naturally occurring radioactive gas that accounts for 56% of the total radiation dose received by the Irish population.

#### **Aim**

1. To measure and compare radon awareness in a high-risk and low-risk radon areas.
2. To determine the factors which influence the level of awareness.

#### **Hypothesis**

1. The level of awareness will be greater in high-risk radon area than low-risk radon area.
2. All houses built after 1997 would have a radon barrier (due to building regulations).
3. Residents in high-risk areas would be more likely to take action after learning about radon.

#### **Experimental Work**

1. Selecting a sample of households in both a high-risk and a low-risk radon area for comparison.
2. Designing, validating, distribution and completion of surveys among the sample householders.
3. Collating and analysing the results using Microsoft Excel Statistics Tool.
4. Presenting data using Tableau.
5. Carrying out site visits to validate findings.



#### **Our Findings**

1. One-third of people in high-risk radon areas are aware of radon compared to one-fifth in the low-risk radon area.
2. The awareness levels found in this survey were much lower than those of a similar awareness survey carried out in 2005 but we believe this is due to differing definitions of awareness.
3. 90% of people supported the idea of a legally required Radon Clear Certificate for new builds.

#### **Recommendations**

1. To standardise the definition of radon awareness.
2. Radon Clear Certificate for new builds a legal requirement

## SciFest@ITB 2017 STAND 13

### Title of Project: A Natural, Economical and Environmental Insect Repellent for Use in 3rd World Countries

**Student:** Molly Measey

**School:** Pobalscoil Iosolde, Kennelsfort Road Upper, Palmerstown, Dublin 20

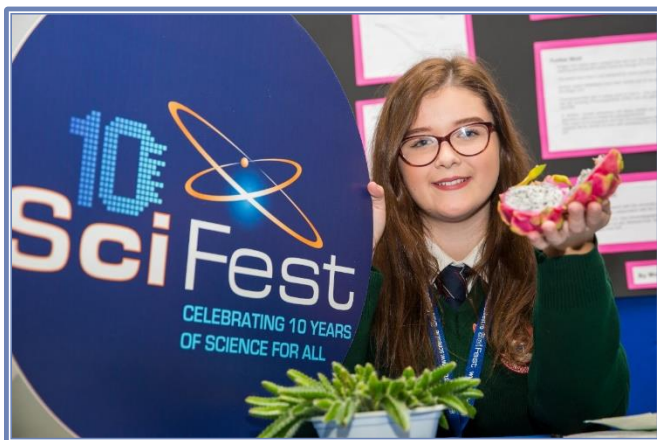
**Teacher Mentoring Project:** Lynda Jordan

**Project Category:** Life Sciences

### ABSTRACT

How can we deter locusts from crop fields, minimising the damage caused to farms in developing countries? While watching a documentary on Capuchin monkeys I noticed that the monkeys began to rub skins of multiple fruits on their body, including dragon fruit. Could dragon fruit be used as a companion crop to deter locusts?

I used lettuce leaves, locusts and a specially designed testing box to investigate my theory. The experimental method involved placing lettuce leaves in the testing box. Some leaves were "protected" by the presence of dragon fruit skins and some were not. Locusts were



placed into the box for a period of time. The amount of lettuce consumed was measured by weight difference. Various techniques were tried but the most successful involved surrounding the leaves with dragon fruit skins. Behavioural issues with the locusts were encountered. For example, the locusts did not like walking on the cold tiles of the test box! It was necessary as a result to warm the tiles before I began each test run.

My results showed that locusts ate an average of almost 33% less of the leaf which was surrounded by dragon fruit skins than the leaf which was left "unprotected". These results are supported by research I found that phenylacetone nitrile (known repellent) is released from cacti. African farmers could use this low-maintenance crop as a companion crop to repel locusts, as a lucrative crop to sell and export and even eat this nutritious crop.

## SciFest@ITT 2017 STAND 14

**Title of Project:** Tutti Fruity: What's in Your Smoothie?

**Students:** Ciara McSweeney, Lucy McMahon

**School:** St Wolstan's Community School, Clane Road, Celbridge, Co. Kildare

**Teacher Mentoring Project:** Paula Kirrane

**Project Category:** Life Sciences

### ABSTRACT

Our project, *Tutti Fruity: What's in Your Smoothie?*, investigates and measures the concentration of three different sugars found in common fruit and liquid ingredients used in homemade smoothie ingredients by investigating how sucrose and lactose are converted into glucose using digestive enzymes lactase and invertase in our bodies.

The project was inspired by our group's love for smoothies. The popularity of Nutri-bullets has caused a trend in the making of homemade smoothies to increase. The sweet taste that you taste from smoothies is undeniably addictive. We wanted to investigate how much sugar our bodies are really consuming from our everyday smoothie recipes. We decided to look for the glucose content instead of the sugar quantity as the glucose content is what our body actually consumes.

**Hypothesis:** Smoothies contain sugar but homemade smoothies have better nutritional values than various store-bought smoothies.

We carried out a series of experiments in order to establish our results and conclusions. The glucose control test tested the ability of our urinalysis test strips. This acted as a control as it gave us clear expected results.

The average time was then found for the enzymes lactase and invertase to change the sugars and lactose into glucose. We carried this out three times and took an average time.

We then tested numerous series of fruits and liquids for a) glucose content after invertase and b) glucose content after lactase. This was also repeated for the various smoothies we compiled.

As an extension, we also decided to compare the glucose quantities from homemade smoothie recipes to a sample of shop-produced recipes. We repeated step three on these various samples such as innocent smoothies, naked smoothies and store-branded smoothies.

## SciFest@AIT 2017 STAND 15

**Title of Project:** Can Beet Beat Other Cattle Feeds?

**Student:** Adam Kelly

**School:** Moate Community School, Moate, Co. Westmeath

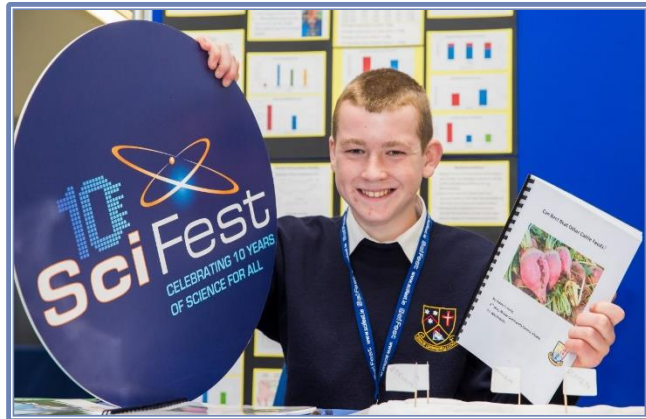
**Teachers Mentoring Project:** Margaret Mandal, Mairead Cusack

**Project Category:** Life Sciences

### ABSTRACT

My project aims to study the nutritional benefits of beet compared to other cattle feeds by monitoring the impact of diet on the daily live weight gain of weanlings and on rumen fermentation rates.

In January 2017 eight heifer weanlings of similar age were selected on my family farm. Over an eight-week period the weight gain of weanlings fed on a diet of silage and 5 kg of either beet or cereal ration was measured. My preliminary results showed that regardless of breed, weanlings fed on beet displayed greater increases in weight than those fed on cereals. After further research I found that beet is deficient in phosphorus. Therefore I repeated these experiments using a phosphorus additive to supplement the beet test which will allowed me to compare two nutritionally balanced diets: beet and commercial cereal grain.



Both feed samples have been tested for organic matter, water and sugar content in the school lab. Fixed masses of faeces have been taken from both groups of weanlings and examined to determine the DMD (Dry Matter Digestibility) for each feed type.

In order to identify the effect of feed type on rumen fermentation rates I collected fresh rumen contents containing live microflora cultures. I monitored changes in the pH, temperature, carbon dioxide, methane and oxygen content of rumen samples over an eight-hour period using probes. The tests were repeated when fixed masses of fresh beet, year old beet, fermented beet and cereal ration had been added.

Using the results collected I hope to identify the true reason behind the success of beet in supporting weight gain and prove that it is a cost-effective feed for the Irish beef herd.

## SciFest@CIT 2017 STAND 16

**Title of Project:** An Investigation into a Safe Pesticide to Control Varroa Mites in Irish Beehives

**Students:** Rachel Hodnett, Maeve O'Regan, Aoife Minihan

**School:** Sacred Heart Secondary School, Convent Road, Clonakilty, Cork

**Teacher Mentoring Project:** Claire Holland

**Project Category:** Life Sciences

### ABSTRACT

Our project is an investigation into the deadly Varroa mites in Irish beehives and the damage they cause. Varroa mites are external parasites that suck the blood from both the adults and developing brood. They can cause abnormalities such as deformed wing virus which disables them from flying out of the hive and ultimately kills them as they cannot leave the hive without falling to the floor.

If a hive is left untreated it can collapse and an entire colony can be eradicated. Mites spread from colony to colony by drifting workers and drones. As a result of this Varroa mites are now epidemic in every hive in Ireland.



For our project we wanted to compare and observe the differences and similarities between chemical and natural known treatments for hives suffering with Varroa infestation. We began our project in November of last year. We used five hives, two with natural treatments (thyme oil and formic acid), two with chemical treatments (Bayverol and Apiguard) and finally our control with no treatment.

The results from our investigation showed us that thyme oil had the best outcome when based on different aspects of prosperity. We concluded from this that thyme oil was the best treatment to use while keeping the hives strong and healthy, while also killing a sufficient number of mites. This led us to continue our investigation using only thyme oil as our treatment on three hives with different application methods (vaporizing and filter paper) and one as our control.

## SciFest@LIT 2017

### STAND 17

#### **Title of Project: Bioassay to Investigate the Effect of both Organic and Non-Organic Fertiliser Runoff on Daphnia Populations**

**Student:** Ruth Daly

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

**Teacher Mentoring Project:** Niamh Naughton

**Project Category:** Life Sciences

### ABSTRACT

The main aim of my project is to investigate the effect of organic and non-organic fertiliser runoff on Daphnia.

Daphnia are aquatic crustaceans which normally inhabit fresh habitats. They are primary consumers as they feed on algae and are a main food source for many fish such as trout and salmon.

Fertiliser runoff contributes to increased algae growth in lakes and ponds. If fertiliser runoff also has a negative impact on Daphnia then this could speed up the process of eutrophication.

Daphnia have a number of natural responses to environmental stress – population decreases, heart rate changes and the egg type produced changes. Under stressful conditions female Daphnia reproduce sexually, where they develop eggs called ephippia.

I have applied the fertilisers to soil samples and filtered to obtain the “runoff.” Daphnia were placed into containers with equal amounts of runoff from different fertilisers. A control container was used to compare results. Daphnia were monitored daily for a period of ten days. I have recorded population changes, average heart rate, egg numbers and egg type.



Results were tabulated and graphed and clearly show that certain fertilisers have a dramatic toxic effect on Daphnia when compared to the control. The organic fertiliser had the least impact on Daphnia populations and responses.

My conclusion suggests that fertilisers with high concentrations of nitrates, sulfates and potassium had the most toxic effect on the Daphnia. Organic chicken manure had the lowest nitrate concentration and did not have the same negative impact.

## SciFest@DCU 2017

### STAND 18

#### **Title of Project: A Statistical Analysis of the Short-term Side Effects on the HPV Vaccination**

**Students:** Savannah-Rose McAuley, Kelsey Wilson, Anna Sowray

**School:** Loreto Secondary School, Balbriggan, Co. Dublin

**Teacher Mentoring Project:** Niamh McNally

**Project Category:** Life Sciences

### ABSTRACT

Our hypothesis is that teenage girls in secondary schools who receive the HPV vaccination suffer from minor short-term side effects following the HPV vaccination.

HPV is a small spherical, double stranded DNA type virus, of which there are 200 strains. HPV is contagious and is spread by physical contact, infecting the mucous membrane. It is the world's most common STI. Annually 300 women are diagnosed with HPV in Ireland and 100 deaths are caused. We selected this topic due to major controversy regarding the vaccine in the media and in schools, and because the uptake of the vaccine has diminished in recent years.

Our investigations included determining the:

1. Vaccine uptake in our school
2. Immediate effects and the effects five hours later of the HPV vaccination on the first-year students
3. Short-term side effects on 600 students in our school and any school absences resulting from the HPV vaccine
4. Reasons parents forbade their daughters to receive the HPV vaccination
5. Difference in opinions of the vaccine between ethnic groups



We believe the negative media controversy surrounding the vaccine had a strong influence on parents. We discovered that 81% of the 1st year students who were surveyed experienced some form of a negative side effect directly after the vaccination such as nausea, vomiting, fainting, etc. Once surveyed again five hours later following the vaccination the short-term effects either remained the same or developed further. We have also investigated the impact of this year's push by the HSE to increase the uptake and will analyse the effect of this on the 2017 statistics.

## SciFest@LyIT 2017 STAND 19

**Title of Project: “Which is the Better Growing Medium for Potatoes?”:  
A Comparative Study into the Effect of Seaweed and  
Homemade Compost on Potato Growth**

**Students:** Mark McAteer, Peter Curran

**School:** Mulroy College, Milford, Co. Donegal

**Teacher Mentoring Project:** Aisling McAteer

**Project Category:** Life Sciences

### ABSTRACT

Our research has made us aware that seaweed is a natural food found all along our coast. It contains 60 essential nutrients that are vital for growth. As we are living along the coastline we have an abundance of seaweeds at our disposal. Plants grow at different rates. Choosing a plant that was slow growing was essential to the progress of the experiment, so as we could measure the growth rate.

Over a three-month period we planted potatoes in different mediums and watched the growth rate. The chosen potatoes were Rooster and Kerrs Pinks. This was carried out at the same time in various areas of locality using the same weather conditions. Although not in a controlled environment, all of the potatoes were exposed to the same conditions.



Our results showed that the compost and seaweed mixture was the best growing medium. The potatoes in seaweed did not survive at all. They did begin to grow but when the seaweed dried out the growth stopped and they died immediately. This was compounded with the fact that there was blight which killed the growth. The clay acted as an insulator as the other potatoes did not grow.

We are interested in going one step further and comparing the growth in ground seaweed and whole seaweed. It is necessary to do analysis of the nutrients present in the seaweed to make a comparison. As studies have shown that centuries ago seaweed was collected and composted in fields for potatoes to grow. If seaweed is an important growth medium it could be utilised more.

## SciFest@NorthWest(NI) 2017 STAND 20

**Title of Project:** Scoby, Scoby, Do

**Student:** Maeve Stillman

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

**Teacher Mentoring Project:** Ann Blanking MBE

**Project Category:** Physical Sciences

### ABSTRACT

This project arose from an article in the media concerning making cellulosic material as a by-product of brewing the probiotic drink Kombucha and using it to make clothes.

SCOBY (symbiotic culture of bacteria and yeast) has been found to have numerous uses. Doing some background research, I found that the material is very hydrophilic. I also found out about other uses for the material and decided to investigate two of them:

1. Growing a cellulosic material from the SCOBY and investigating ways of waterproofing it for use in clothing, using vegetable oil, flax seed oil, virgin olive oil, Briwax, beeswax, petroleum jelly and emulsion, with deionized water as a control. The treated SCOBY material is placed over the open end of a vertical tube containing water with a ruler behind and left for 10 minutes. The difference in water level is recorded. Hypothesis: The smaller the difference in water level the better the waterproofing ability of the material.
2. Investigating the material's possible use for removing metal ions from water using known concentrations of solutions of zinc, lead, iron III and lithium chlorides, and a conductivity meter to follow the concentration of dissolved solids (ions). Hypothesis: If the SCOBY removes ions then the conductivity should decrease.

Results show that beeswax was the most successful waterproofing material but did not give 100% waterproofing. It was decided to make and investigate emulsions as the hydrophilic end should attach to the SCOBY holding the waterproofing lipophilic end in position.

The results of the test for the ability of the SCOBY to remove metal ions was inconclusive. It appeared that ions were being added to the solution from the SCOBY as the conductivity increased. Further work would need to be done to identify the ions present.



## SciFest@ITS 2017 STAND 21

### **Title of Project: EnableArm: The Shaving Device for People with Limited Hand Dexterity**

**Student:** Aaron Hannon

**School:** St. Muredach's College, Sligo Road, Ballina, Co. Mayo

**Teacher Mentoring Project:** Kevin Boyle

**Project Category:** Technology

### **ABSTRACT**

The project was inspired by my late grandfather Joe, who suffered from limited hand dexterity due to a stroke. This left him unable to shave independently – a source of frustration for him. After extensive desk research it was established that no product currently available would have served his needs or those of others. Thus, I hypothesised that there is a need for a device which helps people with limited hand dexterity to shave independently. This was verified through field research – meeting focus groups and distributing and analysing user surveys. Key performance indicators were identified at this stage after user consultation.



Technical research was carried out to assess potential designs. The Stanford University d-School "Design Thinking" approach was used as the design process guideline in this project. Through multiple iterations, repeated testing and a user-focused approach, design concepts were analysed and developed using sketches, CAD and FEA software and 3D printed prototypes to produce a high-quality physical

design. Software and electronic design was approached similarly, using Arduino to code the device's operations. Continual testing was carried out using a mannequin head to develop and refine the design. An Android app was designed and tested to allow greater ease of use, as demanded by users. The initial prototype was critiqued by users in the second user research phase, before more technical refinements were made.

In conclusion, a functional prototype was created that fits the needs of the user and is ready for further development to become a market ready product.

## SciFest@LIT 2017 STAND 22

**Title of Project:** Height Adjustable Crutch

**Students:** Thomas Curtin, Dylan Moloney

**School:** Desmond College, Gortboy, Newcastle West, Co. Limerick

**Teacher Mentoring Project:** Donal Enright

**Project Category:** Technology

### ABSTRACT

Our project is a customisable crutch that helps people with a lower body disability to stand up and sit down more easily. We came up with this idea when Dylan fractured his knee playing a soccer match and he had to get crutches. Dylan was at school one day trying to sit down on a chair, and with normal crutches you have to remove your hands and find your balance on your other leg. While he was trying to do this, he lost his balance and landed on his injured leg. Wishing that there was a device to help him with these challenges, we decided to come up with an idea of our own.

Our device will allow crutch users with varying BMIs to sit down or get to a standing position with ease while they are using our product. By customising the grips to the user we will reduce the usual cramps and pains associated with normal crutch handles.

We discovered the average body mass of a person varies between 18.5 BMI and 25.8 BMI. We also discovered the average weight of a person varies between 45.5 kg and 50kg, depending on gender.

We had the opportunity to demonstrate our device to medical personnel including the Physiotherapy Department in the University Hospital Limerick, doctors, and end users. Our awareness and empathy for crutch users and their injuries as well as the issues they face while using crutches has spurred us to believe in our product and its ability to solve these issues.



## SciFest@CIT 2017 STAND 23

### **Title of Project: An Autonomous Device that Assists Caregivers in their Care of Patients Suffering from Dementia**

**Student:** Danila Fedotov

**School:** North Monastery CBS, North Monastery Road, Cork

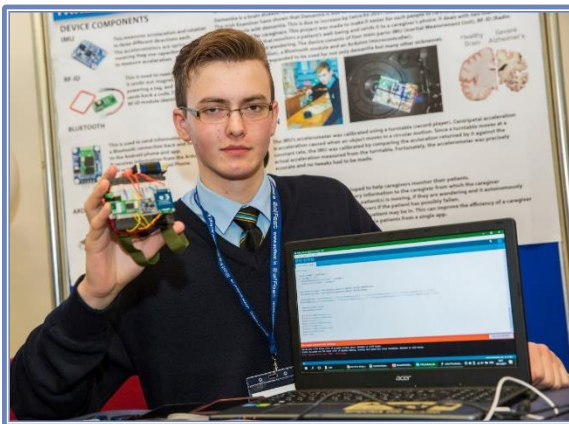
**Teacher Mentoring Project:** Frank Murphy

**Project Category:** Technology

## ABSTRACT

There are multiple reports published by The Irish Examiner, Trinity College Dublin and The Alzheimer's Society of Ireland stating that there are over 48,000 people with dementia living in Ireland and that this number is on the rise. It is expected to triple by the year 2040.

A device has been created to support family carers / caregivers by making it easier for them to monitor the patient. This device is a wrist worn device, by the patient, which uses micro technology and many forms of communication to notify the caregiver of a possible fall using an Inertial Measurement Unit (IMU), the exact location of the patient inside their home using Radio Frequency Identification and the approximate location outside their home using GPS. The caregiver is notified via an Android app or a website which is hosted to display the identical information as on the app. This will make it easier for the caregiver and improve privacy for the patient as they are not required to be checked on as often.



This project was mainly targeted at the symptoms of dementia but is also freely usable with people who have different disabilities or are simply elderly. This project may prove useful in hospitals and elderly homes too. This project's purpose is to improve health care and privacy for the patients and make caregivers more efficient as they can then monitor more patients than normal by simply using an app.

## SciFest@ITB 2017 STAND 24

**Title of Project:** Stopping the Shake

**Student:** Katie Rattigan, Hannah Nugent

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

**Teacher Mentoring Project:** Dr Lisa Darley

**Project Category:** Technology

### ABSTRACT

Inspired by our grandfather who suffers from Parkinson's, we have designed and tested a device that when attached to any cup could counter movement in the cup caused by hand tremors experienced by people with conditions such as Parkinson's Disease. The aim of this device is to give sufferers of Parkinson's more independence and to improve their quality of life.

We have successfully designed, developed and tested a handle that will enable a person with a tremor to drink liquids comfortably without spillage. Our device, which can attach to any type of cup, utilises a levelling system based on a ball bearing to counter the sudden movement experienced during shaking and to re-level the cup.



Using deviation from an angle of 180 degrees as a quantitative measure of the suitability of our device we were able, over the course of nine prototypes, to reduce the mean angle from 35 degrees to 1 degree. Statistical analysis of multiple tests showed our results to be extremely statistically significant, proving our device does have an effect.

# SciFEST 2017

## BOSTON SCIENTIFIC

### MEDICAL DEVICES

#### AWARD FINALISTS



## SciFest@ITS 2017

### STAND 21

**Title of Project:** EnableArm: The Shaving Device for People with Limited Hand Dexterity

**Student:** Aaron Hannon

**School:** St. Muredach's College, Sligo Road, Ballina, Co. Mayo

**Teacher Mentoring Project:** Kevin Boyle

**Project Category:** Technology

This project is also a National Finalist – see page 21 for the project abstract.

## SciFest@LIT 2017

### STAND 22

**Title of Project:** Height Adjustable Crutch

**Students:** Thomas Curtin, Dylan Moloney

**School:** Desmond College, Gortboy, Newcastle West, Co. Limerick

**Teacher Mentoring Project:** Donal Enright

**Project Category:** Technology

This project is also a National Finalist – see page 22 for the project abstract.

## SciFest@CIT 2017

### STAND 23

**Title of Project:** An Autonomous Device that Assists Caregivers in their Care of Patients Suffering from Dementia

**Student:** Danila Fedotov

**School:** North Monastery CBS, North Monastery Road, Cork

**Teacher Mentoring Project:** Frank Murphy

**Project Category:** Technology

This project is also a National Finalist – see page 23 for the project abstract.

## SciFest@ITB 2017

### STAND 24

**Title of Project:** Stopping the Shake

**Student:** Katie Rattigan, Hannah Nugent

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

**Teacher Mentoring Project:** Dr Lisa Darley

**Project Category:** Technology

This project is also a National Finalist – see page 24 for the project abstract.

## SciFest@GMIT 2017

### STAND 25

**Title of Project:** Heart Valve Design and Prototype Development

**Student:** Thomas Hayes

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

**Teacher Mentoring Project:** Marian Lowry

**Project Category:** Technology

### ABSTRACT

Stenosis and leakage are serious heart diseases that affect 1.5 million people in the United states. There is a high mortality rate linked with these diseases. This project sought to design and develop prototype heart valves to treat these heart diseases.

First existing heart valves were researched, and a design brief was prepared. Prototypes were developed using alternative designs and assembly methods compared to existing valve design in the market place. A basic bench test method was developed to compare early prototype designs. Later prototypes were tested using industry standard medical device test equipment. Test results were analysed, evaluated and compared to international standards for heart valves.

The final design achieved the design brief requirements. Readily available resources were used, acceptable haemodynamics were recorded and final designs met international standards for leakage and valve opening. Secondary design brief requirements were met; stainless steel, suture, and bovine tissue were used, which are all nonthrombogenic, inexpensive and accessible. As these materials are already used in existing heart valves they are unlikely to degenerate or damage blood constituents.



Theses valves prototypes, in particular double ring valves, have the potential to be used in surgical aortic valve replacement. They use available and inexpensive materials and they can be easily made to fit typical annulus size. Further development would be required in finalising this design.

The basic test method developed while somewhat crude allowed all prototypes to be compared to each other and to International standards. The Vitro pulse duplicator results demonstrated the limitations of the basic test method and ensured the final design achieved ISO standard for heart valves. The recommendation is that these prototype valves be wear and fatigue tested.

## SciFest@ITC 2017

### STAND 26

**Title of Project:** The Effect of Music on Blood Pressure

**Students:** Fintan Smith, David Kemple

**School:** Coláiste Bhríde, Carnew, Co. Wicklow

**Teacher Mentoring Project:** Miriam Rickerby

**Project Category:** Life Sciences

### ABSTRACT

When we commenced with our project we had a basic goal in mind – to identify and detect the effect of music on blood pressure in the classroom. We hypothesised that there would be a minor rise in blood pressure. However, once results were gathered and through rigorous experimentation our project evolved.

Our initial experiment confirmed blood pressure as our dependent variable and music as our independent variable. Firstly, we acquired our blood pressure at rest. Then using a blood pressure monitor and six music tracks, which were split into two groups named 'calm' and 'energetic', we, while strapped to the monitor and listening to the tracks, established that candidates' pulses significantly decreased when listening to 'calm music'. Additionally, pulses increased dramatically when listening to 'energetic music'.



Implementing the results, we used them in conjunction with a class test. This involved two quizzes, which were completed by the students while listening to the different types of music. The students listening to 'calm music' on average achieved a grade 15% higher.

Then, using a watch that recorded blood pressure, we looked at an average student's week and how their blood pressure fluctuates throughout the day. We focused on how adding music could increase a student's work ethic throughout the day. During lunch the students' blood pressure rose, we suggest that they listen to 'calming music' here. During the middle and end of the day is when the students' blood pressure is at its lowest. We recommend playing energetic music here.

Our findings, in conclusion, assist students by relaxing them in stressful situations.

## SciFest@IT Tralee 2017

### STAND 27

**Title of Project:** Ultra Vision

**Student:** Timothy McGrath

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

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

**Project Category:** Technology

## ABSTRACT

### Aim

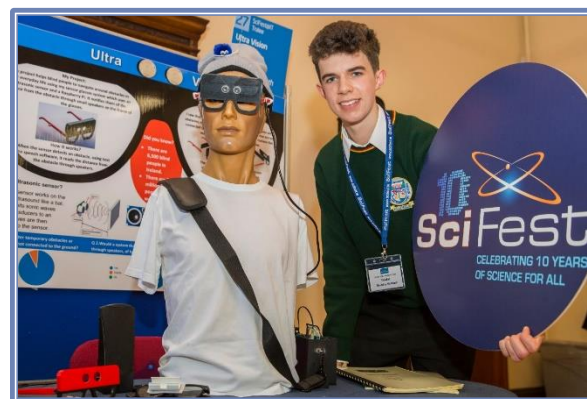
I am investigating/solving the problem that blind people have when they encounter out of the ordinary obstacles in walking the public domain. The categories that these obstacles go under are temporary obstacles or obstacles that are not connected to the ground. Obstacles such as scaffolding, ladders, signage boards and wing mirrors from large vehicles are all hazardous to the blind person. It's not just the natural obstacles, such as overhanging tree branches, rose bushes, etc. they worry about. Blind people have no way of knowing if they are approaching such obstacles. Having witnessed this in my home town on numerous occasions I began thinking and planning a way to solve this problem by using technology.

My project helps blind people to navigate around obstacles in their everyday life using my sensor glasses powered by Raspberry Pi. Over 39 million people worldwide will benefit from my project. The wearable technology, which is run by a small form factor operating system, is seamlessly integrated into a simple pair of glasses. The system will revolutionize how blind/visually impaired people detect and then avoid obstacles. It does this using an

ultrasonic sensor which, using ultrasonic waves, detects obstacles and then gives a reading of how far away the obstacles are. This information is sent to the blind / visually impaired person in the form of audio through speakers.

### Conclusion

I believe I am closing the gap when it comes to using technology to its fullest potential in assisting blind people.



## SCIFEST 2017 AWARD WINNERS

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### SciFest 2017 Science Foundation Ireland Intel ISEF Grand Award Winner

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Student	Aaron Hannon
School	St. Muredach's College, Sligo Road, Ballina, Co. Mayo
Project	EnableArm: The Shaving Device for People with Limited Hand Dexterity
Teacher	Kevin Boyle

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### Berlin Long Night of Science 2017 Award

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Students	Thomas Curtin, Dylan Moloney
School	Desmond College, Gortboy, Newcastle West, Co. Limerick
Project	Height Adjustable Crutch
Teacher	Donal Enright

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### Boston Scientific Medical Devices 2017 Grand Award

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Student	Aaron Hannon
School	St. Muredach's College, Sligo Road, Ballina, Co. Mayo
Project	EnableArm: The Shaving Device for People with Limited Hand Dexterity
Teacher	Kevin Boyle

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**Abbott Ireland 2017 Award**

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Students	Shannon McHugh, Ciara Keaveney
School	Glenamaddy Community School, Glenamaddy, Co. Galway
Project	Fire Ashes – An Undervalued Nutrient
Teacher	Deirdre Hardiman

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**THEA 2017 Award**

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Student	Omar Salem
School	Sutton Park School, St Fintan's Road, Sutton, Dublin 13
Project	Protecting Turbofans from Foreign Object Damage
Teacher	Catherine Tattersall

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**ISTA 2017 Award**

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Student	Adam Kelly
School	Moate Community School, Church Street, Moate, Co. Westmeath
Project	Can Beet Beat Other Cattle Feeds?
Teacher	Margaret Mandal

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**SciFest 2017 10th Anniversary Award**

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Student	Jack Nagle
School	Killorglin Community College, Killorglin, Co. Kerry
Project	Tractor Safe Lock
Teacher	Donal O Reilly