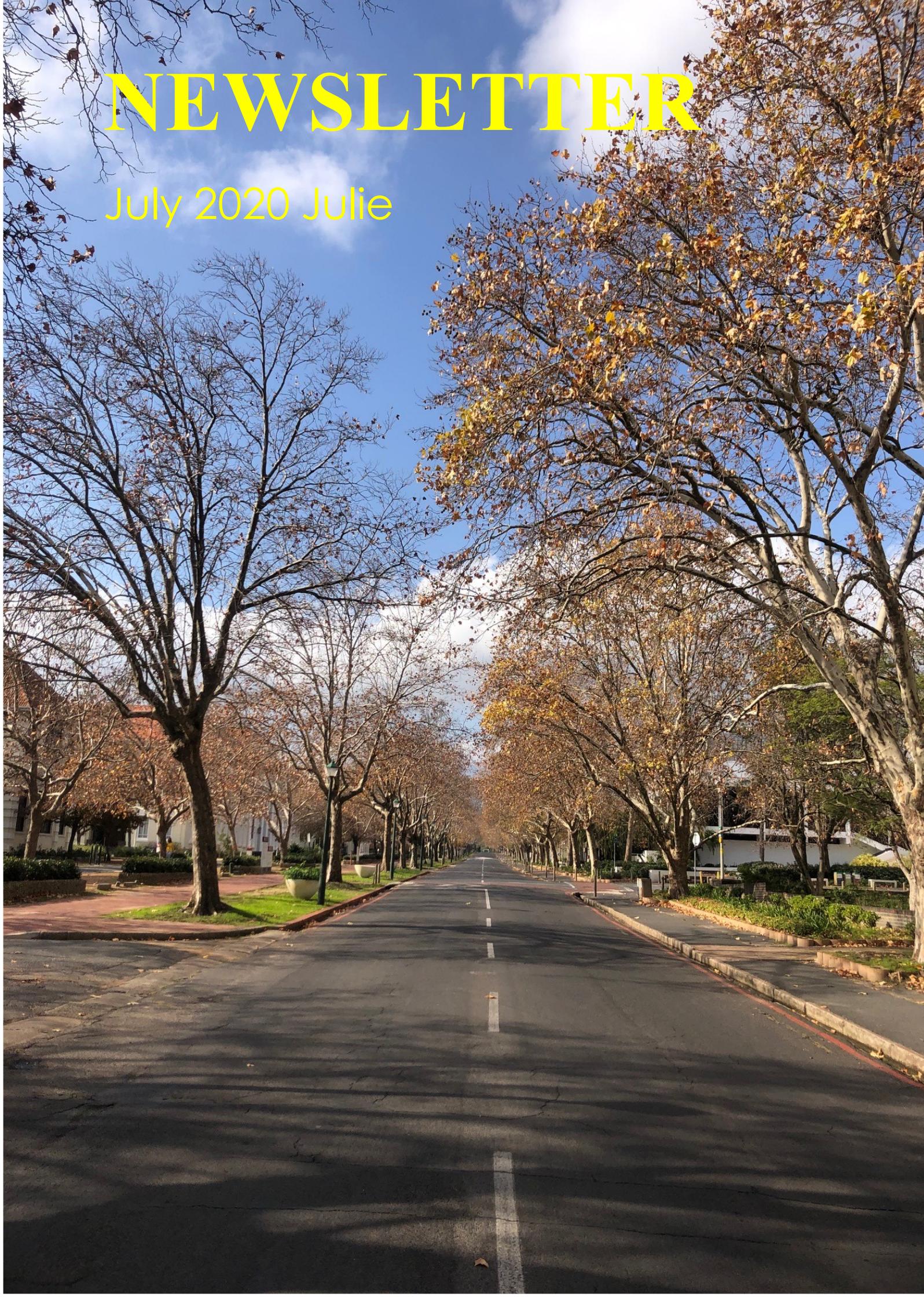


# NEWSLETTER

July 2020 Julie



# 2020 the year Stellenbosch's campus went quiet ...

I hope you will enjoy reading this newsletter amidst the pandemic that we find ourselves in. We thought it was important to keep up some of the usual routines and the Department of Food Science Newsletter is just that – a regular visitor to your inbox.

What a different year it has been! None of us would ever have predicted this at the beginning of the year, but here we are. It is a strange year, in that we get lost in the seemingly endless lockdown, that we forget that there was a time in 2020 that we weren't in lockdown and led normal lives. But it is also a time to acknowledge the extraordinary achievements that we have accomplished during the lockdown period.

It's hard to believe that in 2020, pre-lockdown, some of us actually went overseas. Prof Marena Manley presented a keynote lecture in Thailand, Dr Maricel Krügel went to Belgium to visit KU Leuven regarding New Product Development and I was in Chicago in January for IFT business. We also hosted international guests from the Netherlands, Scotland and South Korea for the Centre for Food Safety's Advisory Board meeting in late February. Now air travel, especially international air travel, seems a foreign concept.

We all had to adapt to the "new abnormal" – working from home, online learning, Zoom, Microsoft Teams and Skype meetings, hand sanitising and recognizing people in masks. Times like these require adaptability and often also lead to innovation. Take for example, Dr Erika Moelich, who is continuing sensory science trained panel research, by delivering samples to be tasted to the panellists, who are now doing their sensory evaluation remotely. Dr Stefan Hayward and some colleagues realised that hand sanitiser was in short supply and showed that discarded bread could be converted into alcohol for the production of hand sanitiser.

As usual there have also been more awards and graduations. In this issue you can also read about the SPIE Award that Dr Paul Williams won and about the April Graduation – four PhD's, ten MSc's (6 *cum laude*), seven BSc's and two MSc's in Food & Nutrition Security.

Enjoy the newsletter, and stay safe and healthy!

Prof Gunnar Sigge





## 2020 kicked off well for Dr Paul Williams

Food scientist Dr Paul Williams is among 13 distinguished young professionals recognised by [SPIE, the international society for optics and photonics](#), as one of its 2020 DCS Rising Researchers. Dr Williams is a lecturer and researcher in the Department of Food Science in Stellenbosch University's Faculty of AgriSciences.

He is the only academic among the thirteen in the 2020 DCS Rising Researcher group not associated with an American university. They will be recognised on 27 April 2020 at the SPIE Defence + Commercial Sensing (DCS) 2020 conference in California in the USA. (Due to the outbreak of the worldwide Covid-19 pandemic, Dr Williams did not attend this Conference)

According to a press release by SPIE, its Rising Researcher initiative is now in its fourth year. It recognises early-career professionals who are conducting outstanding work in product development or research in the areas of defence, commercial, and scientific sensing, imaging, optics, or related fields such as astronomy and food science.

At SPIE DCS 2020, he will present some preliminary findings on the use of near infrared (NIR) hyperspectral imaging to distinguish between different types of game meat and game meat cuts. This work, together with his postgraduate students on its use as an ID method for South African game species such as springbok and blesbok, follows on those done by other researchers on kangaroo and reindeer meat.

Dr Williams says he received the good news about his inclusion late December whilst on honeymoon. At the time, he was checking emails because an urgent funding application was due. "Funders do not care about honeymoons," he dropped.

His field is all about how light interacts with a product, and how the highly sensitive camera within imaging instruments picks up on the different chemical signals and converts it into images. "With NIR we can see chemical differences or similarities on the computer that we cannot see with our eyes. It allows us to visualise the potential differences or similarities between different materials or objects, from food to minerals. Each have their own chemical 'signal'," he explains.

Dr Williams says the issue of food fraud was top of mind when he started this work. "Once it is cut, you cannot really distinguish kudu from springbok meat, for instance, and therefore we need methods that can do so."

Current DNA identification methods can be quite costly, and time-consuming.

"Our NIR studies have already shown that there are definite chemical differences between the meat of species, such as blesbok and springbok and between different muscles in their bodies," he explains.

Dr Williams specializes in the use of vibrational spectroscopy and imaging techniques, such as NIR spectroscopy and hyperspectral and multispectral imaging. He is also interested in data analysis. To this end he has returned to student life this year. He is part of the first intake of students to follow a new postgraduate industrial engineering diploma with a focus on data science at Stellenbosch University.

Dr Williams has been using imaging techniques in his research since his masters degree years under supervision of now colleague Prof Mariana Manley of the Department of Food Science.

One word was all it took to interest him in the field. "While I once was chatting with Prof Manley about possible postgraduate options, she mentioned the word 'chemometrics'. It intrigued me, although I did not know what it meant," he remembers how he became interested in the science of extracting information from chemical systems by data-driven means.

When he googled chemometrics he found that it involves a lot of maths, statistics and potentially also computer programming.

"I just knew I wanted to do that," emphasises Williams, who over the years has taught himself some coding.

In 2007, the year that he started his masters' degree studies in food science, he attended his first conference on NIR in Sweden – and was hooked for life. He used this technique during his PhD studies to work on a non-destructive way to grade and evaluate the quality and safety of maize kernels.

A doctoral student, Kate Sendin, has since built upon his initial work, to develop what could be a "lite" version of a NIR hyperspectral imaging system to easily do relevant testing on site. "The next step would be to involve engineers and designers to develop a cheaper, more specific system that can be commercialised and used in industry by silo managers and the likes," he says.

To date, Dr Williams has published 19 papers in peer-reviewed journals and has supervised, to completion, 2 PhD students and 10 MSc students.

(Article by Engela Duvenhage, Photo Anchen Lombard)

## First advisory committee meeting of the Centre for Food Safety, February 2020



An information session on food safety trends were presented to members of the food industry by the Centre for Food Safety at Stellenbosch. The speakers were (from left) Prof Stephen Forsythe, a retired professor in microbiology at Nottingham Trent University, UK, Prof Wilhelm Holtzapfel, president of the International Committee on Food Microbiology and Hygiene (ICFMH), Prof Mieke Uyttendaele of the Department of Food Technology, Safety and Health at the University of Ghent and Ms Isabelle Desforges from Biomerieux (France). With them is Prof Pieter Gouws of the SU Department of Food Science, and director of the SU Centre for Food Safety.

Photo: Marco Oosthuizen

Despite all the technological advances of the past century, there is one basic thing that people have simply not yet managed to learn: to wash their hands. Diseases and germs will not spread so widely if people can only start doing this properly.

This was the message from Prof Stephen Forsythe, a retired professor in microbiology at Nottingham Trent University in the UK, and author of the Handbook "The Microbiology of Safe Food" which is widely prescribed to university students. He was the opening speaker at an afternoon session on the future role of science in maintaining food safety. The event, hosted by the Centre for Food Safety at Stellenbosch University's Department of Food Science, was widely supported by members of the local food industry.

Forsythe gave an overview of future trends that he thinks will impact on food safety matters. He mentioned the influence of climate change and a growth in insect farming and related products. He also noted that consumers are increasingly looking for more plant-based protein products, and food containing lower in additives. Antimicrobial resistance, which relates to the way in which germs have adapted to current drugs and treatment, is also a growing source of concern in the food industry.

"We have no other choice than to adapt to these trends, because they are here to stay," he mentioned.

Forsythe said most of the 8914 food products that were withdrawn from the market worldwide between 2008 and 2018 were raw fish, prepared food and nuts and fruit. This was mostly due to the occurrence of undeclared ingredients that could cause allergic reactions, and the prevalence of germs such as *E. coli* and Salmonella that are associated with food poisoning.

According to Forsythe, four cases of food poisoning are reported daily in the USA. He says that infections are a worry in aging populations. Older people are more susceptible to infections, and therefore standards around food safety should be intensified.

Forsythe says technology to test for incidences of disease-causing organisms have improved drastically over the past years. He added that many problems related to infections and germs can be curbed if people were just able to follow basic standards of hygiene in homes, factories and on farms.

Also among the speakers at the afternoon session were Prof Mieke Uyttendaele of the Department of Food Technology, Safety and Health at the University of Ghent (Belgium), and Prof Wilhelm Holtzapfel, president of the International Committee on Food Microbiology and Hygiene (ICFMH). They addressed attendees on the value of making decisions on food safety matters based on good evidence and findings, and the role of the ICFMH in maintaining standards around food safety. Ms Isabelle Desforges from Biomerieux in

France spoke about the value of microbial standards such as ISO and other microbiological testing methods.

### Centre for Food Safety

The speakers were in Stellenbosch for the annual advisory committee meeting of the Centre for Food Safety in the SU Department of Food Science. It was established in November 2018 thanks to support from the South African food industry. It followed on the listeriosis crisis. The Centre is still the only one of its kind in the country. Researchers at SU, colleagues and members of the food industry have since been working together to investigate specific issues regarding food safety, to raise awareness and to provide advice and change policies where possible.

"It is a privilege to have people of their calibre on our advisory committee. It was fitting to have them speak to people from our local food industry. They were also able to share their knowledge with our students during special lectures," notes food microbiologist Prof Pieter Gouws, director of SU Centre for Food Safety.

Prof Gouws says he is grateful for the progress that has been made over the past year through the Centre for Food Safety, and for the good cooperation between partners in academia and food industry.

"We are learning from each other," he emphasised. "That's why our motto is 'innovation through collaboration'."

Studies have already been completed on the prevalence of antimicrobial resistant bacteria among livestock and wildlife in South Africa.

A survey was done on the prevalence of *Campylobacter* and *Arcobacter* species in ostriches. A One Health approach was followed to investigate *Listeria monocytogenes*, the bacterium that in 2018 caused an unprecedented listeriosis outbreak in South Africa. Research was done to ascertain to what a degree it is prevalent in food, the environment and clinical isolates in the Western Cape.



## Attending ANS2020, just in time before the world-wide Covid-19 lockdown

I was privileged to be invited to present a talk at one of the last Conferences to be held, nationally and internationally, before the outbreak of the Covid-19 pandemic resulted in a world-wide lockdown. I presented on *Near-infrared (NIR) spectroscopy of agri-food products: from humble beginnings to the quality control method of choice* at the 7<sup>th</sup> Asian Near infrared (NIR) Symposium (ANS 2020) in Khon Kaen, Thailand (12-15 February). The meeting was co-organised by the Asian NIR Consortium (ANC) and Asian Near infrared Thai-committee from the Rajamangala University of Technology, Khon Kaen, Thailand. This was the second Asian NIR Symposium I had the privilege to attend as invited speaker; the previous meeting in Shanghai coincided with the 2010 World Expo.

The Asian NIR symposiums aim to share knowledge and strengthen collaboration between researchers in Asia. These symposiums also serve as excellent platforms giving postgraduate students the opportunity to present their research as either poster or oral presentations at a conference hosted on an international level, however, without the pressure of presenting in front of a large and intimidating international audience. I commend the organisers for this initiative.

Knowing that Thailand ranks sixth among almost 200 countries for the world's strongest health security, and the highest

in Asia, I considered it safe to attend the meeting. However, I did take safety precautions moving through Suvarnabhumi airport in Bangkok. Thailand is known to see 11 million Chinese visitors every year. At the time of the conference, the reduced number of travelers were already noticeable and it was reassuring to see the majority of travelers wearing face masks; and so did I.

In spite of the World Health Organisation's advice that travel restrictions were not yet necessary at the time, the Chinese delegates were prohibited from traveling to Thailand. This unfortunately resulted in a reduced number of delegates, but it had no impact on the quality of the conference. One of the invited speakers from New Zealand, who also could not travel to Thailand, presented his lecture via a video presentation. The organisers also made the effort to print and display the posters of delegates from China who could not attend, still giving their research exposure. As was the case in 2010, I was hugely impressed by the innovation and high-quality research performed by young researchers in Asia and by the excellent organisation of the conference. Also, I was overwhelmed by the kindness and friendliness of the people of Thailand, fittingly known as the 'Land of Smiles'. (M Manley, photos & text)



# When life gives you lemons, make hand sanitiser.

Author: Engela Duvenhage

If you have the right equipment, some ingenuity and a few loaves of bread, it seems you can do almost anything in times of crisis. That is what Stellenbosch University food scientists have proven, having made 18 litres of alcohol-based hand sanitiser from stale bread crumbs in their in-house fermentation tank. After a weeklong process, they were able to bottle the end product hours before South Africa went into lock-down because of Covid-19.

Departmental staff was able to take a good supply of hand sanitiser home. A few bottles were left at the ready in the Food Science building, for when authorised staff visited the facility to check up on the running of experiments.

"It smells just a little bit like toast," says Dr Stefan Hayward, a postdoctoral researcher in the Department of Food Science at Stellenbosch University (SU).

He is part of a research group in the Department who on a normal day focuses on ways to reduce food waste being produced on the one hand, and on another on ways to put these by-products to use.

"Waste implies a need to discard something which has become useless and needs to be disposed of. We see waste products and the tendency to produce too much food not as a problem, but as raw ingredients or by-products that can provide the impetus to invent new ways of reducing, reusing and recycling," he explains the rationale behind their work.

The plan to make their own hand sanitiser came a day after the Presidency announced self-isolation measures, during a brainstorming session between Dr Hayward, another postdoctoral researcher, Dr Timo Tait and MSc food science student Sebastian Orth.

"We were talking about alternative uses for some of the everyday items we often discard, bread being one of them," remembers Dr Hayward.

One thing led to another, and they decided to try and produce bio-ethanol from bread with which to make hand sanitiser.

"Bread is composed of 40% starch which can be used as an excellent carbohydrate source during the production of bio-ethanol via fermentation," explains Dr Hayward.

"The global Covid-19 pandemic has highlighted the need for better hygiene practices and adequate supplies of antiseptic products such as hand sanitiser to help 'flatten the curve'," he added.

They knew that they'd have no problem finding their main ingredient, because unsold bread past its sell-by date is generally returned to distribution centres from where it is discarded as waste, or at best used as animal feed.

They were able to obtain dried bread crumbs from one of their industry partners, Innovative Research Solutions (IRS). IRS, in turn, is currently helping a major food producer make something worthwhile out of the large amounts of bread returned daily to its distribution centres. The idea is to convert this waste stream into functional ingredients that can be put to new use.

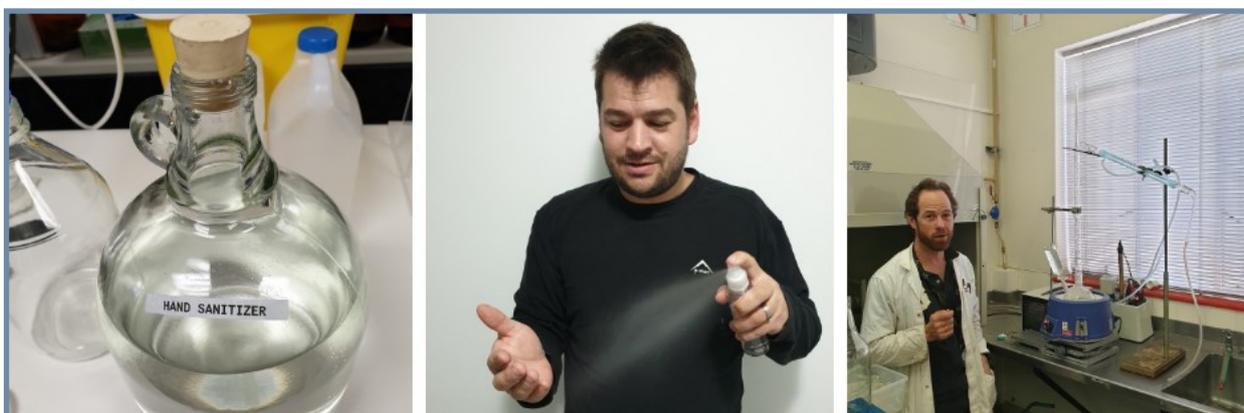
In the Department's fermentation tank, they combined 60 kg of bread crumbs with hot water and added alpha amylase enzymes that are regularly used in the food industry to the mix. They then adjusted the pH level to optimal levels to convert starch to sugar. The mixture was then incubated at 65°C for 60 minutes to enable saccharification and therefore sugar production. Thereafter, the mixture was cooled to 30°C before a specialised yeast strain used by the distilling industry was added.

The end product, which looks very much like mashed potatoes, was left at room temperature for seven days until the fermentation process was complete and they could start distilling the mixture.

From the initial 60 kg of bread in their first batch, they were able to produce 10.5 litres of 75% ethanol. Using a recipe found on the Internet, it was combined with ingredients such as glycerol, hydro peroxide (that also kills viruses and bacterial spores) and a denaturant to ultimately make 18.2 litres of hand sanitiser.

Because of the lockdown the researchers could not continue their work, but they hope to do so once the situation returns to normal in the country.

"We were able to satisfy our scientific curiosity whether or not we would be able to ferment bio-ethanol from a waste product such as stale bread, and at the same time were also able to apply our knowledge to produce an antiseptic formula that can be of help in this time of crisis," says Dr Hayward.



# Sensory Lab at Food Science operating at the 'new normal'

Covid-19 has fundamentally changed the world we live in. The pandemic has a profound influence on how we go about our everyday lives, how we socialise with friends, how and when we exercise and how we go about doing our jobs.

With the current levels of lockdown, restriction on movement and the risk to the sensory panel to attend training and testing sessions at a central facility, we had to adapt our way of working and conducting sensory tests.

Dr Erika Moelich, one of the members of the sensory team at the Department of Food Science, Stellenbosch University, obtained a permit to work at the sensory lab at the department under current levels of lockdown. A new way of sensory testing for our panel was in the making. After valuable feedback from colleagues Ms Nina Muller and Dr Jeannine Marais, and the very practical input of Mrs Anna-Marie Leygonie, the logistics were covered.

Our @Home sensory testing now entails that we prepare and label all samples for the panel at the central sensory laboratory, following all the regulations stipulated by SU and the Department of Higher Education and training to reduce the spread of the coronavirus. A "sample set" is prepared per panel member including samples for both training and testing, training questionnaires, reference standards, palate cleansers, disinfectant and even a small snack to enjoy after completing the test. The sample kits are delivered to panel members with clear instructions on how to store and prepare the samples. Training is done via video conferencing software, with instruction to remove samples and prepare the training area sent in-time to all participants. Training in this way is effective, focused and works extremely well under the current circumstances. The final sensory profiling is completed using online questionnaires via Compusense Cloud, a registered internet-based software program for sensory testing.

There is no doubt that a crisis causes many problems, but it also creates opportunities for innovation within research. This "new" way of completing sensory tests has enabled us to continue with our scheduled projects, using available technology and resources in an innovative way. We do wish to commend all the members of our two sensory panels for the positive manner in which they undertook this new venture with us.

Dr Erika Moelich is currently Manager of the Sensory Research Laboratory at the Department Food Science, Stellenbosch University ([em@sun.ac.za](mailto:em@sun.ac.za)).

(Photo & article: E Moelich)



Dr Erika Moelich, (photo left) and her team found a way to continue their research program despite the Covid-19 restrictions. Samples are packed in boxes and home-delivered to the panel members.

# Equipping students with tools for multivariate data analysis

Janine Colling and Stephanie Phelps

Making sense of multivariate data, which is closely linked to the Fourth Industrial Revolution can be rather complex. Multivariate data is described as the 'simultaneous analysis of multiple measurements obtained from individuals or objects'. This data can also originate from various sources ranging from chemical data to consumer sciences. As a result, the analysis of these 'big dataset' often requires some specialized skills.

Stellenbosch University has recognized that there was an opportunity to provide this type of training. Currently various courses and degrees are available at the new School for Data Science and Computational Thinking. Since the data generated at the Vibrational Spectroscopy unit (CAF) is often of this nature, a concerted effort was made with the Department of Food Science to invite an international expert in this field to host a three-day workshop at STIAS.

Professor Federico Marini, currently an associate professor at the Department of Chemistry at the Sapienza University of Rome, has many years of experience in this field. His PhD focused on developing chemometric tools to evaluate the quality of food products. He is regarded as an expert in this field by his peers and was therefore an excellent choice to present the workshop.

The aim of the training was to provide the 30 participants who had different levels of experience in data analysis, with a basic foundation. The course was packed with information from the history of chemometrics and basic fundamental principles to the more challenging aspects of pretreating data and predictive modeling. The morning sessions focused on understanding the theory behind the different analysis. Afternoon sessions were dedicated to practical examples to demonstrate real-world applications. Participants also enjoyed direct access to Prof Marini to get assistance with data analysis and to discuss potential new collaborations. There were also ample opportunities to network and meet with like-minded colleagues, faced with similar objectives.

The positive feedback received indicated that there would be value in repeating this workshop on an annual basis. Anyone interested in attending training workshops can contact Dr Janine Colling ([jcolling@sun.ac.za](mailto:jcolling@sun.ac.za)). Alternatively, please consult the Central Analytical Facility's website (<http://www.sun.ac.za/english/faculty/science/CAF>) for more information about the CAF annual training initiative. The National Research Foundation is thanked for providing funding to host the workshop through the Knowledge Interchange and Collaboration Grant. During the workshop we learned that the way we interact with data is evolving. As a result, keeping up with new analysis trends, is becoming more imperative to making better decisions for the future.



Pictured here are twenty eight of the thirty workshop participants. *From the front (left to right):* Celeste Maping, Sarah Clarke, Kiera Lambrecht, Elizma van Wyngaard, Manzi Sishi, Risa Bagwandin, Charney Anderson-Small, Mareli Moolman, Ebrahima Arendse, Brannigan du Preez. *2<sup>nd</sup> row (left to right):* Aladino Jasse, Fabian Smith, Michelle van der Walt, Irmie Hoffmann, Manda Rossouw, Carla Weightmann, Sean-antha Baros, Alexia Naudé, Federico Marini, Sanette van der Merwe, Ruben Badenhorst, Frederic Izingizwe. *Last row (left to right):* Janine Colling, Isabel dos Santos, Ilani Mostert, Sebastian Orth, Lené van der Walt, Stephanie Phelps, Mfesane Nkwenkwezi.

Photo: Prof Marena Manley

# US Graduation ceremony, cancelled...

All graduates received their qualifications in absentia in March this year. We are very proud of the four PhD (see below), two Master of Science in Food and Nutrition Security, Adriaan Badenhorst and Thobile Phungwayo, and ten Master of Food Science in Food Science degrees awarded to the following candidates:

Edwards, Richard (*cum laude*); Febbraio, Tanino; Jordaan, Kayla-Anne (*cum laude*); Kavela, Efaishe; Keet, Rochelle (*cum laude*); Makhubo, Qhakazile Angel; Mapling, Celeste; Psarrakis, Judi (*cum laude*); Rust, Alexandra Elizabeth (*cum laude*); Smit, Paula (*cum laude*).

Seven Bachelor of Science in Food Science degrees were also awarded.

**MILLER, Neil** (Food Science)

*Development of a gastroretentive anti-diabetic nutraceutical incorporating polyphenol-enriched fractions of Cyclopia genistoides*

A protocol for the production of fractions enriched in xanthenes and benzophenones from a *Cyclopia genistoides* (honeybush) extract was established for the development of an anti-diabetic nutraceutical, with mode of action the inhibition of intestinal alpha-glucosidase (AG). Enrichment was achieved by subjecting the extract to ultrafiltration, followed by adsorbent resin chromatography of the permeate. The xanthone-enriched fraction was more potent as AG inhibitor *in vitro* than the benzophenone-enriched fraction and showed greater synergistic interaction with the drug acarbose. This suggests potential for a combination therapy. *Ex vivo* intestinal transport studies confirmed poor absorption of these compounds in the gut, the site of action.

Supervisor: Dr CJ Malherbe (*external*)

Co-supervisor: Prof E Joubert (*external*)

**LUFU, Robert** (Food Science)

*Transport phenomena in pomegranate fruit: Mechanisms of weight loss and control strategies*

Pomegranate fruit is highly susceptible to moisture loss during storage and transportation, causing an economic loss in the industry. The findings of this study showed the mechanisms of water loss in pomegranate fruit and characterised the structural and quality changes in storage and transit. The study followed a comprehensive approach using micro-imaging techniques, computational modelling and experimentation. The study highlights surface waxing as the potential solution for controlling water loss in pomegranates.

Supervisor: Prof UL Opara

Co-supervisor: Dr AA Tsige

**SHANGE, Nompumelelo Benedicta** (Food Science)

*The prevalence of Campylobacter and Arcobacter species in ostriches from South Africa*

*Campylobacter* and *Arcobacter* species are emerging pathogens that have the potential to cause gastrointestinal infections in humans. Infections in humans are mostly caused by the consumption of contaminated poultry products. Currently, microbial specifications/regulations for the South African meat industry have not been set. With this study, a pre-emptive approach was taken to determine whether ostriches harbour *Campylobacter* spp. and *Arcobacter* spp. and whether contamination could occur during slaughter. Findings from this study will help shape future regulations that will ensure the safety of ostrich meat consumers.

Supervisor: Prof PA Gouws

Co-supervisor: Prof LC Hoffman

**SENDIN, Kate** (Food Science)

*Reduced wavelength spectral imaging for grading defect and asymptomatic Fusarium detection in white maize*

In this study, spectral imaging is proposed as an alternative to manually sorting white maize. The aim of the system was to classify maize according to South African white maize grading legislation and detect asymptomatic *Fusarium* fungal contamination. Due to high costs and slower analysis times associated with hyperspectral imaging, waveband optimisation was used to reduce the amount of data required for accurate classification. The system showed promise for maize grading, where defective maize kernels and foreign materials were classified with moderate to high accuracies. Asymptomatic infection detection was not possible using this technique; however, the ubiquity and significance of *Fusarium* contamination in South Africa were revealed.

Supervisor: Dr PJ Williams

Co-supervisor: Prof M Manley

## Maricel Krügel off to KU Leuven ... many moons ago...

Dr Maricel Krügel obtained funds from the International Collaboration Mobility Grant for a two week visit to KU Leuven in Belgium in February 2020. She was invited by Professor Leen van Campenhout as a visiting fellow to the campus based in Geel. Prof Van Campenhout is the research coordinator at the Lab4Food where a wide array of technologies is combined to, amongst others, generate insights into quality characteristics, with a special focus on insects as new feed and food matrices. Maricel was invited to attend a two-week yearly module called "Insects in food and feed" which was presented by various researchers in Flemish. This was a unique experience and she was amazed how well she could follow and understand. She spoke Afrikaans most of the time. There was a lot of synergism identified between the two programs and hopefully a long-lasting relationship can be established on the research as well as on the educational side. Besides all the academic activities Maricel had time to enjoy a few Belgian beers. *Santé! Schol!*

(Photo's and text: M Krügel)



Teams meeting during lockdown ... It is quite amazing how quickly we've all adapted to the new normal. This screenshot was taken last week during an informal coffee meeting. On the next 2 pages members of staff and students shared some photos of things they kept themselves busy with during the first few weeks of lockdown.





**Error-based Learning**  
Multilayer Neural Networks: Training of PUNNs

Hidden-to-input weight updates:

$$\Delta v_{ji} = \eta \left( \frac{\partial E}{\partial v_{ji}} \right)$$

$$= -\eta \frac{\partial \text{net}_{j,p}}{\partial v_{ji}} \frac{\partial \text{net}_{j,p}}{\partial v_{ji}}$$

$$= -\eta \delta_{j,p} \frac{\partial \text{net}_{j,p}}{\partial v_{ji}}$$

$$\frac{\partial \text{net}_{j,p}}{\partial v_{ji}} = \frac{\partial}{\partial v_{ji}} \left( \sum_{i=1}^I z_{i,p} \right)$$

$$= \frac{\partial}{\partial v_{ji}} (e^{z_{i,p}} \cos(\pi \phi_{i,p}))$$

$$= e^{z_{i,p}} [\ln |z_{i,p}| \cos(\pi \phi_{i,p}) - \mathcal{I}_i \pi \sin(\pi \phi_{i,p})]$$

Output-to-input weight updates:

$$\Delta u_{ki} = \eta \left( \frac{\partial E}{\partial u_{ki}} \right)$$

$$= -\eta \frac{\partial E}{\partial o_k} \frac{\partial o_k}{\partial u_{ki}}$$

$$= -\eta \delta_{o_k} z_i$$

$$\mathcal{I}_i = \begin{cases} 0 & \text{if } z_{i,p} > 0 \\ 1 & \text{if } z_{i,p} < 0 \end{cases}$$

Engelbrecht and Smith-Dumont Applied Machine Learning, Butterworth-Heinemann, 2003, pp. 1007





This is how lockdown progressed for some Food Science students and members of staff. Like the rest of the world it started out with empty streets and a lot of gourmet cooking and baking. Kids were entertained and some even planted flowers and vegetables. Dogs were very lazy and bored, another one was adopted into a loving home. There were funny tricks on horseback, silly haircuts and workouts around the house. Even Doc Craven wore a mask. Paul Williams did crazy Maths and the rest of us had to find new and creative ways to work from home. From the 1 May it got better when we could start exercising outside. Stellenbosch is blessed with such beautiful mountains and nature. I hope these pictures bring back happy memories in a few year's time. In the meanwhile, please keep safe.