

ANZFSS SA Branch Newsletter

June 2017

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Society News

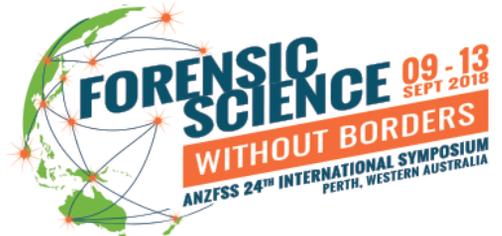
Exciting news! The website and social media pages for the next ANZFSS Symposium in Perth are now up and running!

Website: www.anzfss2018.com

Facebook: www.facebook.com/ANZFSS2018/

Twitter: @anzfss2018

Instagram: anzfss2108



Its sure to be another successful and worthwhile Symposium.

A Message from the Secretary:

It's the time of year now that memberships are being renewed! Just over half of the current membership have renewed so far, which is great to see. For those that haven't renewed yet and are planning to, please do so by end of June. If it lapses past September, there is a late fee.

For any non-members out there that have been thinking of joining, now is the time of year to get the most out of your membership fee as we follow the financial year! Just head to the website (www.anzfss.org) and follow the links. For your membership, you get free entry to regular meetings, discounted entry to our larger events (such as end of year dinners), discounted registration to the ANZFSS Symposia every two years and if you cannot make a meeting, many of them are video recorded and put up on the website in a members-only area. We also provide scholarships and other special awards to members which make attending the ANZFSS Symposia or other scientific meetings much more affordable.

We are also leading up to the Annual General Meeting, where we will be looking for nominations for the SA Branch Committee for 2017-2018. Being on the Committee involves a meeting every 6 weeks, some tasks to do and assistance at the Branch Meetings, which are also every 6 weeks or so. If you are interested in joining the Committee, please keep an eye out for the nomination forms, which will be coming out via email, and will be placed onto the website soon.

Dan Butzbach



The Travelling Scientists

The night kicked off strong with a presentation from poster-award-winner Kareana Uern speaking about the research she presented at the ANZFSS National Symposium in Auckland late last year. Kareana's study was based on the frequency of glass fragments present on the clothing of general public – or 'Random man' as the scientists put it.

In the aim of updating and comparing results with previous studies conducted, Kareana gathered multiple samples from the general public of Adelaide to test their clothing for the presence of glass fragments. Her poster entitled "Random Man Glass on the Clothing and Shoes of the General Population in South Australia" included the unexpected (or expected?) results and frequency of glass observed, and also the characterisation of glass using a method known as GRIM (Glass Refractive Index Measurement).



UWC-A helping local communities from PNG, France, Belgium, East Timor and Indonesia.



Forensic specialists working on grave sites.

Then followed our very own President, Natasha Mitchell. Natasha was the recipient of the ANZFSS Allan Hodda Memorial Award 2015 which afforded her the opportunity to travel to the United States to attend the 27th International Symposium on Human Identification in addition to visiting a number of prestigious international laboratories.

Natasha is a dedicated member of Unrecovered War Casualties – Army (UWC-A) and works tirelessly with her other team members to help bring back the currently >35000 war dead fallen heroes to their families. With the help of mitochondrial and YSTR DNA analysis as well as dental records and artefacts found with the remains, ancestry and familial lineage can be determined and the remains finally laid to rest.

Unfortunately though, there's not always a familial reference to compare to. In addition, as with all potentially historic projects, the process in both DNA recovery and identification can be complex when dealing with degraded samples. Overcoming these issues is a major focus of laboratories across the world with most turning towards Massive Parallel Sequencing (MPS). MPS is a cost effective process by which whole genomes can be sequenced providing much more genetic information than current methods that only identify repeats in non coding regions of DNA. MPS provides the ability to look at many different markers in a persons DNA simultaneously; including Short Tandem Repeats, single base changes and X and Y chromosomal markers.

Natasha's overall aims for her few months travel were to attend an International Symposium for Human Identification (ISHI) held in Minneapolis, where she could identify and learn new technologies being developed to identify degraded human remains. By attending multiple labs across USA such as AFDIL located in Dover, UNTHSC in Texas, and the DPAA in Hawaii, Natasha was also able to identify potential UWC-A service providers as well as strengthening links between UWC-A and current providers.



The Travelling Scientists cont.

Natasha spoke of fascinating new technologies such as the HirisPlex Assay which provides Hair colour/shade and Eye colour predictions using 24 DNA markers. It was suggested that maybe this type of analysis would be beneficial in terms of determining racial origin – however this is stressed to be an informative tool.

Overall most labs dealt with MPS when it came to degraded samples and with good results to note. UNTHSC in Texas were able to identify from femur/ tooth remains that were approximately 140 years old and determine the origin to be that of a European male with light red hair and brown eyes.



UWC-A group including research officers, historians, investigators, mapping and imagery experts, support staff, forensic odontologists, archaeologists, anthropologists and forensic biologists.

The Defence POW/MIA Accounting Agency (DPAA) in Hawaii are a massive team with collaborations between universities, NGO's, volunteers and other corporations. They manage an impressive >100 identifications per year over countries such as North and South America, Europe, Middle East, Africa and Asia Pacific!

The DPPA have a dedicated facility to analysis and treatment of the remains as well as the ability to 3D print bone fragments and skeletal remains for research purposes. In contrast to the UNTHSC, the DPAA samples all bones submitted.

Overall Natasha's trip was highly successful and beneficial to both herself and the UWC-A – and us! The insight we gained from listening to Natasha speak was inspiring and extraordinary.



UWC-A
Unrecovered War Casualties – Army

Finding Australia's Fallen



The Real Breaking Bad

We started off the meeting with a humorous 3-minute presentation by Emma Kent, a PhD Candidate from Flinders University. Her presentation “Cooking up an Answer – or why I make drugs at Uni” was both entertaining and very informative. She made her thesis project easy to follow with her analogies of what it is that makes Grandma’s apple pie so good such as the spices and other ingredients, to how illicit drug chemists can identify the synthetic pathway used to make drugs based on the small concentrations of impurities and by-products present in the pills and powders seized by law enforcement. Emma won the 3 Minute Thesis (3MT) competition at Flinders University and went on to represent Flinders at the 2016 Asia-Pacific 3MT Competition last year.



Flinders University
student Emma Kent

Following Emma we had our main speaker, Ben Painter from Forensic Science SA, speak about some of the types of work he encounters as an illicit drug and clandestine laboratory chemist in SA, and how that compares to what is seen in the hit TV show, Breaking Bad.

The chemists at Forensic Science SA can assist SAPol in the investigative stage before any arrests are made or attendance at a scene is needed. One example of this can be by looking at intelligence to help SAPol understand what drugs might be made at a clandestine laboratory (AKA clan lab) based on the chemicals and solvents that have been purchased

Once a clan lab is found by SAPol, one of the 4 on-call chemists will attend and do some work alongside SAPol officers. This includes making the scene safe for investigators due to the serious chemical hazards present, identifying what chemical process was happening in the crude reaction vessels, safely dismantling the equipment that is there, and taking samples for further testing. When the chemists are back at the FSSA laboratories they will analyse samples from the scene along with any other drug seizures brought in for analysis to determine what the drugs actually are and the purity of the drug in the material. They then also prepare reports for further intelligence or court purposes.

In SA, there are both imported and locally made illicit drugs found. For those that are imported, these tend to include heroin, cocaine and LSD. Considering that Tasmania produces ~25% of the world’s opium poppy crop for the pharmaceutical production of codeine, it is surprising that heroin (also from opium poppy) does not appear to be made in Australia. In terms of drugs manufactured locally, these include GHB (fantasy), cannabis, methamphetamine and MDMA (ecstasy).

Ben then went into some of the manufacturing trends when it comes to one of SA’s most prevalent drugs – methamphetamine. In the past, methamphetamine tended to be made using phenyl-2-propanone (P2P), then it was by using pseudoephedrine (cold and flu tablets) however that and some of the other chemicals became regulated. The clan lab manufacturers then moved to other compounds such as benzaldehyde, and so it goes on. There is also a trend for boxed or mobile labs as it makes for easy transport and the manufacturers can simply rent out a hotel room overnight, cook up their drugs then pack up and move on in the morning.



The Real Breaking Bad cont.

In terms of hazards that are found at clan lab scenes, these are numerous and can include acidic or caustic chemicals, gas bottles, solvent vapours in enclosed spaces and unlabelled chemicals. Sometimes there may be phosphine gas present which is heavier than air, colourless and odourless – if someone is present, they can easily become unconscious and die from asphyxia. Other drugs such as ammonia and hydrochloric acid attack the lungs and mucous membranes in the body, such as the mouth and oesophagus. A very real danger is that solvent vapours can accumulate and cause explosions, as evidenced by photos from a scene in SA where a gas cylinder exploded and was embedded in a wall at about head height, and the walls of the house and the side fence were blown out from the blast. Another factor that impacts on safety at the scene is that they are often very messy and cluttered, so that a lot of these previously mentioned hazards won't be clearly visible until the mess is removed. It is for these reasons that the chemists that attend these scenes with SAPol have protective suits, breathing apparatus and certain gas sensors for their own safety.



Forensic Science SA chemist and clandestine laboratory expert Ben Painter.

One of the more volatile methods of making methamphetamine that is occurring is what is called the “shake and bake” method, which first appeared in the mid-west and north-east of USA. It is basically a one-pot reaction that is portable, such as a plastic drink bottle in someone's bag or car boot, and contains lithium, a flammable solvent and water. In about a third to half of these, the reaction vessel will rupture causing a fire or explosion making it very dangerous for anyone nearby.

In terms of the methamphetamine that is found in SA, there are a number of physical forms which it may present as including powders (ingested, injected and inhaled), tablets, liquids, paste (injected) and crystals (smoked). The crystal form is what is known as “ice”. The vast majority of methamphetamine in the last couple of years has been of the crystal form and has effectively been “uncut”. This is in contrast with previous years where there was more of the powder or paste present. One theory is that users are more comfortable smoking the crystal form than having to intravenously inject the powder form, making it a bigger market for the illicit drug trade. Whichever way the drug is administered, it is highly addictive, detrimental to the user's health and leads to further family and socio-economic problems. Both the Federal and State Governments around Australia have announced “Ice Taskforces” in recent years to tackle this problem.



“My Teacher said I’d Need Maths One Day”

“If you cant explain something simply, you don’t understand it well enough.” Dr Duncan Taylor – a Senior Forensic Scientist at Forensic Science SA and Supervisor of honours and PhD students at Flinders University let us in on the secrets of DNA statistics. His topic spanned three main methods; Markov chain Monte Carlo, Bayesian belief networks and artificial neural networks. Despite those three topics seeming scary and significantly beyond the lay-person’s statistical understanding, Dr Taylor was able to clearly explain the uses of these three fascinating techniques and their application to forensic science reporting.



Dr. Duncan Taylor presenting at the ANZFSS SA branch meeting

Duncan explained that using both the laws of probability knowing only your current outcome, you can make predictions on what the following outcome will be. This is the basis of the Markov Chain. Scientists are able to use this method to sort through large amounts of data and predict outcomes based on the current situation. Interestingly the same methods can be used to predict weather forecasts as well as rank web pages when browsing.

The second part of this method – Monte Carlo – arose from a secret nuclear research facility in USA, and was inspired by playing a game of solitaire. Rather than mathematically calculate the probability of success, it can be assigned experimentally by playing repeated hands. These two theories combined formed what is now known as the Markov Chain Monte Carlo (MCMC) approach and is used for predictions in such areas as the stock market, mining and phylogenetics.

In forensic practise, MCMC is used to predict the most likely genotypes of contributors to any given DNA profile. Duncan made the analogy that in a 4 person mixed profile for example, taking into account the DNA profile, degradation and amplification variability, the amount of possible solutions equate to the total number of atoms in the observable universe. By using MCMC the most likely solution to explain the profile may be found in just a fraction of steps. I know what you’re thinking... thank goodness for Solitaire!

Moving onto Bayesian belief networks, we learnt how to gamble. No, really. Suppose you're on a game show, and you're given the choice of three doors: Behind one door is a car; behind the others, goats. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 2, which has a goat. He then says to you, "Do you want to pick door No. 3?" Is it to your advantage to switch your choice?





“My Teacher said I’d Need Maths One Day” cont.

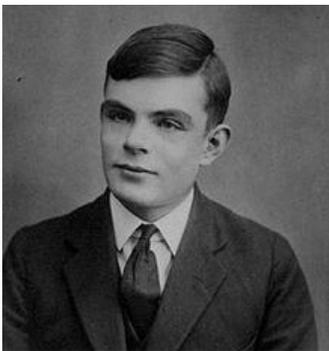
The answer is yes folks, the laws of mathematics say you will have more success choosing the other door. Twice as likely to win in fact. But why? Well, let’s say you choose door 1, you have 33% chance of winning the car. Therefore 66% chance the car is in doors 2 or 3. The host then reveals door two to be a goat. So the chances are still 33% that the car is in door 1, however 66% that the car is in door 3



Natasha Mitchell – SA Branch President
and Dr. Duncan Taylor

Seems a little dodgy, but it goes to show that even simple problems can be really difficult to think through logically. Cue Bayesian belief networks. Bayesian networks are able to use known information and combine them to inform us on probabilities for what we don’t know. I.e. statistically weighting evidence and combining the factors to determine the probability of another event. This was demonstrated in the early 90’s by Colin Aitken to assist police in sexually-motivated child murders.

The value of Bayesian belief networks is the ability to evaluate the probabilities of the forensic findings, given different prosecution and defence versions of events. It’s a step forward in the forensic community to not only stating the evidence, but also the context and possible meaning of the found evidence to aid the court in its decisions.



Alan Turing (1912-1954)

Finally, Duncan covered the use of Artificial Neural Networks – and no, we aren’t talking about Skynet. Alan Turing conceptualised some of the base theories of artificial neural networks while cracking the Enigma code.

A.I. was then recognised later in 1956, but the basis for these networks were rules and failed to live up to the ‘Turing test’.

Machine based learning came to fruition in the 1980’s and was based on the networks of the human brain. Neurons connected to each other in the brain are stimulated and ‘fire’ signals through the network to stimulate other neurons, creating a thought. The process was repeated, but using mathematics.

There are many current uses for artificial intelligence in society, some more impactful than others. Artificial brains are able to play computer games, drive cars and identify cancer to name a few. In Forensic Biology, Duncan is attempting to create an artificial network to analyse the results that are produced from electrophoresis so that scientists don’t have to complete this sometimes laborious task.

One of the main problems, however, comes from the potential for the computer to ‘learn’ bias. Artificial brains learn based on the input given to them. So if the information provided is in any way biased, so too will be the output from the computer. As always no process is ever fool proof and the need for in-depth understanding is vital if the future is to depend on this type of problem solving.



Upcoming Meeting

ADIFF

Advanced DNA Identification and Forensic Facility

27TH JUNE

Starting the night off we will be hearing the latest from the Executive ANZFSS committee. Our very own Adrian Linacre – President of ANZFSS, will be updating us on progress at the executive level and the flow on effect to branches.

Following will be a stimulating presentation from the Advanced DNA Identification and Forensic Facility. ADIFF is a specialised network of forensic scientists who apply cutting edge DNA technology to a broad range of biological samples from degraded human remains, plant and animal material through to environmental samples. ADIFF provide insight into many different scenarios from crime scenes, missing persons, illegal trade, biosecurity and conservation management.

Joining us to present their specialised areas will be;

Assoc. Professor Jeremy Austin

Professor Adrian Linacre

Professor Michelle Waycott

Dr Eleanor Dormontt.

Their presentations cover a range of topics such as ancient DNA analysis, wildlife DNA and forensic science, plant fragments and weed identification and timber tracking for geological sourcing respectively.



WHERE: Flinders in the City, 182 Victoria Square, Adelaide.

WHEN: 27th June, 6:30 for 7pm start

BOOKINGS: Members: FREE
Non Members: \$10

ONLINE: <http://members.anzfss.org/booking.php?id=39>

*Please note that there are no refunds for no-shows for non-members. If a non-member is unsure of their attendance, please send an email to sabbranch@anzfss.org with a tentative RSVP and you may pay at the door on the night.

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ANZFSS South Australia

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WARNING: The ANZFSS (SA Branch) Committee wish to advise that the material presented at some ANZFSS meetings can be of graphic or explicit nature. Some of the material presented may disturb or offend some people. Persons attending meetings do so at their own risk. For this reason, we recommend that persons under the age of 17 years do not attend meetings.

Views and opinions expressed within this publication are not necessarily those of the Australian and New Zealand Forensic Science Society or the SA Branch.