NOVEMBER | 2023

BIO-BABBLE

Newsletter of the Australasian Biospecimen Network Association

BACK TO THE FUTURE!

Welcome to the November edition of Biobabble where we step into the fascinating world of Biobanking as we embark on a journey taking us through the past, present and the future!

We start with Dr Rose Upton, inaugural recipient of ABNAs Emerging Leader Scholarship, joining us for the November edition of 5-minutes with a biobanker. She will then take us on a journey of how her younger years influenced her life as a biobanker exploring the critical role of wildlife preservation.

In the spotlight are two joint recipients of the NSW Australian of the Year award, making them eligible for the national award. We celebrate their outstanding contributions to the field of biobanking and how they've made a lasting impact.

Let's travel back in time! Learn about the thylacine, a species that once roamed the Australian wilderness, and the biobanking efforts underway for its de-extinction.

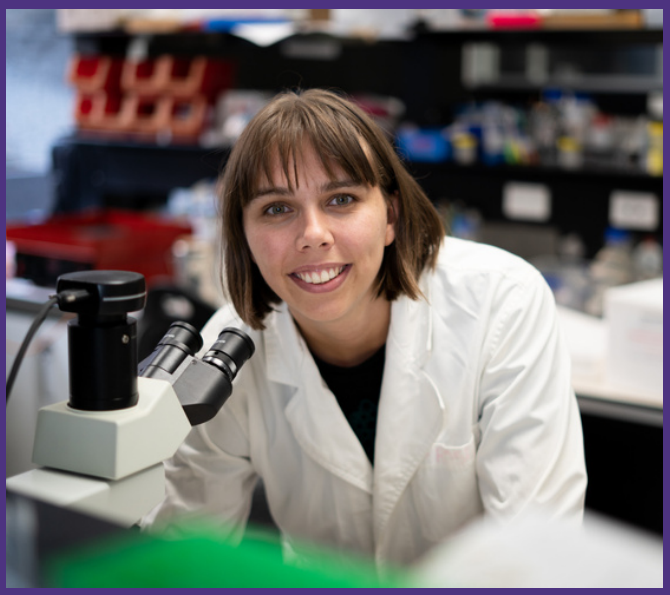
ABNA wants you!

Don't forget to take part in one of ABNA's new initiatives – The Special Interest Groups.
You have four to choose from, join now!

Get ready for 2024 as ABNA travels to Adelaide!
Biobanking: Shaping the Future Together
Be sure to save the date!

5 MINUTES WITH A BIOBANKER

We approach a different professional in the biobanking arena with the same five questions each month.



This month Dr Rose Upton, inaugural recipient of ABNAs Emerging Leader Scholarship, responds to our questions. Dr Upton is a Postdoctoral Researcher at the University of Newcastle, Wildlife Biobank.

THE QUICK QUESTIONS

Red or white wine?
Neither, cocktail menu please

Mac or PC?
PC

Batman or Superman?
Batman
(I really prefer Spiderman, truth be told!)

Lord of the Rings or Harry Potter?
Harry Potter

1. **How long have you been working in biobanking?**
   10 years (including undergrad, honours and PhD)
2. **Which advance in science/research do you think has had the most impact on you as a biobanker?**
   Some new and exciting areas of research for wildlife biobanking include innovations in field-friendly biobanking tools, as well as capacity to freeze larger cells (e.g. eggs).
3. **In retrospect, given the experience you have now, what one piece of advice would you give to yourself at the start of your biobanking career?**
   Pick a field with more funding? I don't think I'd really give myself that advice because I was and am so passionate about wildlife conservation. But maybe to pay attention to scientific communication options outside of traditional outputs sooner so that we can better advocate for funding in this space.
4. **What is the craziest thing you have done to save a sample/s?**
   Given my samples are in LN2 I try to limit the crazy to around this one area. However, I can say one of the craziest things I've done to obtain a sample is go swimming in a very cold pond in the middle of the night in order to catch a very rare and valuable frog as the first representation of that population in our biobank - no regrets!
5. **Your career on record: name 3 songs/albums that best tell the story of your biobanking career:**
   This war is ours - Escape the Fate
   A story to tell - Woe, is Me
   We own the night - Dance Gavin Dance

We hope you have enjoyed reading 5 minutes with a Biobanker for 2023. Of our 10 respondents this year there was an equal split for the Mac/PC, LOTR/Harry Potter and Batman/Superman quick questions - although Doctor Who and Spiderman (as above) have also been thrown into the mix as first preference. We had the same number of biobankers who would choose a white wine or a soft drink (3 in each category) and the same number of red wine drinkers as those who preferred a cocktail (2 in each).

5 min with a Biobanker will be back in 2024 with some new questions - if you would like to nominate someone for this segment please get in touch with us at: info@abna.org.au

australasian biospecimen network association

ABNA SPECIAL INTEREST GROUPS

JOIN NOW

Clinical Trials & Population Cohort Biobanking

This SIG aims to bring together expertise to facilitate improvements and promote excellence in biobanking for clinical trials, cohort studies and related research across Australasia. It aims to provide a formal networking space for likeminded biobank teams within Australasia.

SIG Chairs
Ilka Priebe - Ilka.Priebe@csiro.au
Jennie Hui - Jennie.Hui@health.wa.gov.au
Wayne Ng - Wayne.Ng@cancervic.org.au

Post-mortem Tissue Collection

A collaborative task force to consolidate learnings and best practice in post-mortem biobanking, support new banks establishing protocols and lobby for infrastructure support in adult, paediatric and veterinary research.

SIG Chairs
Cassandra Griffin
Cassandra.Griffin@newcastle.edu.au
Louise Ludlow
ouise.ludlow@mcri.edu.au

Banking for Biodiversity

This SIG aims to understand, improve and promote the use and implementation of biobanking as a conservation action for the management of Australasia's biodiversity. Their aim is to share information between biobanks to improve program sustainability, collaboration and promote the value of biobanking to relevant stakeholders.

SIG Chairs
Emma Dalziell
emma.dalziell@uwa.edu.au
Rose Upton
rose.upton@newcastle.edu.au

Quality Management and Improvement

A community that identifies quality and improvement gaps and areas of interest and facilitates forums to tackle identified topics.

SIG Chairs
Samantha Higgins
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Beth Caruana
Beth.Caruana@health.nsw.gov.au

THE FUTURE IS NOW - A REFLECTION ON ABNA BIOBANKING ON RECORD

by Dr Rose Upton

As a child I was endlessly fascinated with nature; birds, insects, our unique marsupials, or really anything outside. My first collection was a list of bird species that I had encountered within my backyard and a tally of how many I had seen - and in hindsight, it wasn't a big leap to biobanking from there. My research focusses on the development and application of assisted reproductive technologies to the conservation of wildlife, in particular amphibians. The concept of a sperm bank for cryopreserved human sperm has been around since at least the 1800s. However, it wasn't until the late 1990s that the value of biobanks for amphibians was recognised. This was in response to the discovery that amphibians were undergoing drastic declines due to a fungal disease that has now spread globally - now that we've experienced our own global pandemic, we may have a better understanding of the severity of amphibian declines. Afterall, there are no mask mandates and social distancing for our poor froggies and this fungal disease is still causing ongoing declines and extinctions today.

In response to this discovery, studies on the cryopreservation of amphibian sperm began to appear, along with reports of embryos fertilized with frozen sperm through IVF. By biobanking from amphibians and other wildlife, it is possible to preserve genetic diversity (which allows adaptation to disturbance such as climate change and increased fires). Additionally, it provides a last insurance against extinction, as the collection of live cells in the form of sperm and cell lines may allow technologies such as cloning to save a species. Despite this, there is no national infrastructure for wildlife biobanks and only in recent years have we seen biobanking applied to actual conservation projects. Opening the lines of communication on the plight of amphibians and other wildlife is key to furthering the resources and support available to this emerging area of biobanking. It is possible that combined efforts to leverage infrastructure for multidisciplinary biobanks (e.g. preclinical, agricultural and seed banks) may provide a path moving forward.

This brings me to my involvement with ABNA and my hopes for the future. In 2021, I was asked to present to the virtual (thanks covid) annual conference and my eyes were opened to just how diverse the field of biobanking really is. Here I was invited to present on our first applied project in this emerging field: biobanking sperm from amphibians affected by the devastating 2019/20 megafires. However, navigating any field as an early-career researcher can be tricky without continuity of funding (both for infrastructure and personnel), and thus it is only with recent support from ABNA in the form of the Emerging Leader Scholarship that I have recently been able to officially join ABNA and attend my second ABNA conference, Biobanking on Record.

And what a conference it was! This conference exposed me to a multitude of biobankers from several fields, including my own. Many speakers reflected on the beginnings of their own biobanks, and the realisation that the potential for my wildlife biobanking to grow into a similar success story is more encouraging than I can say. A multidisciplinary team of biobankers, working together to achieve a common goal is an amazing thing, and that's what ABNA represents to me. The acknowledgement that we should, as a community, work collaboratively towards a goal of sustained funding and infrastructure gives me so much hope for the future of not just my own emerging field of biobanking, but others too.

The conference marked the launch of the Special Interest Groups that have recently been established with ABNA. Four incredible groups, including the Banking for Biodiversity Special Interest Group. The conference allowed me to meet and interact with my co-conspirators in this group and I am so excited to see what we can achieve over the next few years. Through my involvement with ABNA and the SIGs, I hope the next year will bring my field greater impact. Increasing awareness and opportunity for databasing our collections is just one of the goals we aim to target within our SIG to increase the impact of wildlife biobanks in Australia. With the help and support of this community I am confident in furthering our goals.

This conference marked the 20th anniversary of ABNA and looking to the future, I feel that this contribution and investment from the biobanking community into my emerging field of biobanking will give me a steppingstone to continue my journey. In another 20 years I hope to be thinking back fondly of this moment when I attend the 40th anniversary ABNA conference.

2023 CONFERENCE FEEDBACK SURVEY

If you attended ABNA's 20th Annual Conference, Biobanking on Record on the Gold Coast we invite you to complete the conference satisfaction survey. Your valuable feedback is essential in helping the Conference Organising Committee to identify areas for improvement and what worked well for future events.

We would like to hear from as many attendees as possible.

CLICK HERE
to access the survey

2024 NSW AUSTRALIANS OF THE YEAR

by Valerie Jakrot

It is a great honour that Prof Richard Scolyer AO and Prof Georgina Long AO, co-Medical Directors of Melanoma Institute Australia (MIA), have been awarded joint NSW Australian of the Year and are now in the running for the national award. They have been recognised for their significant contributions to cancer research, focussing on melanoma. More recently, following Richard's diagnosis with a glioblastoma, they have used their knowledge in melanoma to advance treatment options for Richard. Treatments for glioblastoma have not changed much over the past 20 years and his prognosis is grim. Richard is hoping what they can learn from treating his disease in a novel way will improve outcomes for others.

Obviously biobanking plays a major role in this. Biopsies of Richard's tumour were collected soon after diagnosis and again after a couple of doses of neo-adjuvant immunotherapy. Blood samples have been collected at regular time-points. The translational labs at University of Sydney and Macquarie University have collectively joined forces in this ground-breaking research.

Richard is no stranger to biobanking. He helped to set up the first melanoma biobank in the late 1990's and then used grant funding obtained in 2006 to establish a larger biobanking team that has continued to evolve. It's success has been largely due to Richard taking a personal interest in reviewing the tissues that are banked and developing protocols for other pathologists to follow.

Georgina, a medical oncologist and translational researcher got involved in biobanking in her early days at MIA, establishing a biobank clinical trial to assess treatment effect in patients biosamples (both blood and tissue).

Richard and Georgina actively collaborate with other clinicians and researchers on a national and international scale. Both were recently awarded by Clarivate as highly cited researchers for 2023 – an award given to recognise significant and broad influence in their field of research. https://www.sydney.edu.au/news-opinion/news/2023/11/15/sydney-academics-recognised-for-impact-in-highly-cited-list.html

Source: australianoftheyear.org.au

Valerie Jakrot is the Head of Research Managment, Melanoma Institute Australia and a member of ABNA's Management Committee. For queries specifically relating to the Melanoma biobank please contact Valerie or MIA Head of Biobank, Dr Nicole Caixeiro.

BIOBANKING FOR DE-EXTINCTION OF THE THYLACINE

By Dr Louise Ludlow

De-extinction is the process of reversing animal or plant extinctions by creating new versions of previously extinct species. This process is no longer considered scientific fiction – think Jurassic Park!! A decade ago Australian scientists revealed they had grown embryos of the extinct gastric brooding frog. Although the embryos, created from museum samples, died after three days, they represented the crucial first steps of an attempt at de-extinction of a species. The thylacine, or Tasmanian Tiger or Tasmanian Wolf as it is also known, represents a compelling case for de-extinction. Thylacines represent a case of convergent evolution and were eradicated because of direct human influence less than 100 years ago rather than through natural processes such as those that led to dinosaur extinctions.

The thylacine roamed the dry eucalyptus forests, wetlands, and grasslands, the coastal areas of the southern Australia mainland, as well as the forests and grasslands of Tasmania. The thylacine disappeared from the mainland less than 2000 years ago, however, a population of thylacines became isolated, remaining on Tasmania. This population soon faced a new threat – the arrival of the early European settlers. In 1888 the thylacine was labelled as a "sheep killer" and persecuted for killing livestock with a Tasmanian government-imposed bounty fetching £1 per animal and 10 shillings per juvenile animal destroyed. 3,500 thylacines were killed through human hunting between 1830 and the 1920s. Habitat destruction, competition with wild dogs and foreign diseases also contributed to decline of the thylacine population and the species was declared extinct in 1986.

The thylacines sandy yellowish-brown to grey fur was adorned with 15 to 20 distinctive dark stripes, stretching from its shoulders to the tail. Not only was it Australia's sole marsupial apex predator, but the female also had a unique back-opening pouch, while males had a partial pouch. With its slow and stiff movements, it was mainly nocturnal or semi-nocturnal, it was a silent hunter targeting kangaroos, marsupials, small rodents, and birds. Despite its relative slow speed, it was highly intelligent and tenacious, and thus played a vital role in the ecosystem.

The National Film and Sound Archive of Australia (https://youtu.be/6gt0X-27GXM) has released colourised footage of the last known surviving thylacine. The remains of the last-known thylacine supposedly transferred to the Tasmanian Museum and Art Gallery was thought lost for more than 85 years, were found to be kept in a cupboard in a Tasmanian museum which had for decades previously used it as a touring exhibit.

The race has begun to bring back the thylacine! The TIGRR (Thylacine Integrated Genetic Restoration Research, https://tigrrlab.science.unimelb.edu.au/) lab led by Professor Andrew Pask has received funding from Colossal Laboratories and Biosciences (https://colossal.com/) who are also working to bring back the woolly mammoth.

TIGRR LAB
Thylacine Integrated Genetic Restoration Research

The TIGRR Lab, located within the School of BioSciences, in the Faculty of Science at the University of Melbourne is a research center focused on marsupial conservation and restoration.

The TIGRR Lab has three main research themes:

1. **Marsupial genomics and improvement of the thylacine genome:** aiming to produce the best quality genome possible to learn more about the biology of this unique marsupial and to aid in its de-extinction.
2. **Refinement of methods for the derivation and maintenance of marsupial stem cells:** to establish methods that could be used to biobank diversity in our Australian marsupials. This will also help protect against species loss from habitat destruction and other stressors such as predation or competition with invasive pests.
3. **Development of assisted reproductive techniques in marsupials:** techniques such as IVF and cloning are very well established in placental mammals, but completely lacking in marsupials.

Research into thylacines relies on banked specimens which are recorded in the International Thylacine Specimen Database (ITSD). The ITSD has been designed as a free access academic tool to promote and facilitate undergraduate and postgraduate research into the species. It can be accessed through the offices of the curators and heads of department of the universities and museums that hold thylacine material or alternatively through the libraries of several major zoological societies.

The ITSD lists all available catalogue data for each individual specimen e.g. holding institution, catalogue identification number, sex, date of acquisition, specimen type, source, locality, collector, field number, old or additional catalogue numbers, purchase or exchange information and finally any additional remarks pertaining to the specimen. To support the data component and to significantly enhance its educational worth, high-resolution digital images of the specimens are included. Specimen material within the ITSD comprises skins, skeletons, skulls, taxidermy mounts and wet specimens. Wet specimens are whole animals, organs or body parts that have been preserved in either alcohol or formalin. Specimens of the thylacine are spread extensively around the globe so the search to locate these specimens was from the outset an international search involving a total of 106 museum, university and private collections in 23 countries. As of 2022, 756 specimens are held in 115 museums and university collections in 23 countries (http://www.naturalworlds.org/thylacine/biology/specimens/specimens_1.htm). The master copy of the ITSD is held at the Zoological Society in London with mirror copies held within the University of Tasmania in Hobart, the Australian National Wildlife Collection in Canberra and the Queen Victoria Museum and Art Gallery in Launceston,

In 2009 the first two complete mitochondrial genome sequences of the thylacine were reported (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2652203/) and provided a high-fidelity reference sequence for thylacine population genetics while showcasing how appropriate use of museum specimens can deepen our understanding of evolution and the extinction process. A comparison of the two sequences showed that they differed in only five nucleotides out of 15,452, hinting at very low genetic diversity shortly before extinction.

A draft whole genome sequencing of the thylacine was produced by Feigin et al. (2017) using DNA extracted from an ethanol-preserved pouch provided by Museums Victoria. Since this time, sequencing of the thylacine genome has been improved upon (https://www.nature.com/articles/s41559-017-0417-y) and the fat-tailed dunnart one of the thylacine's closest living relatives has also been sequenced.

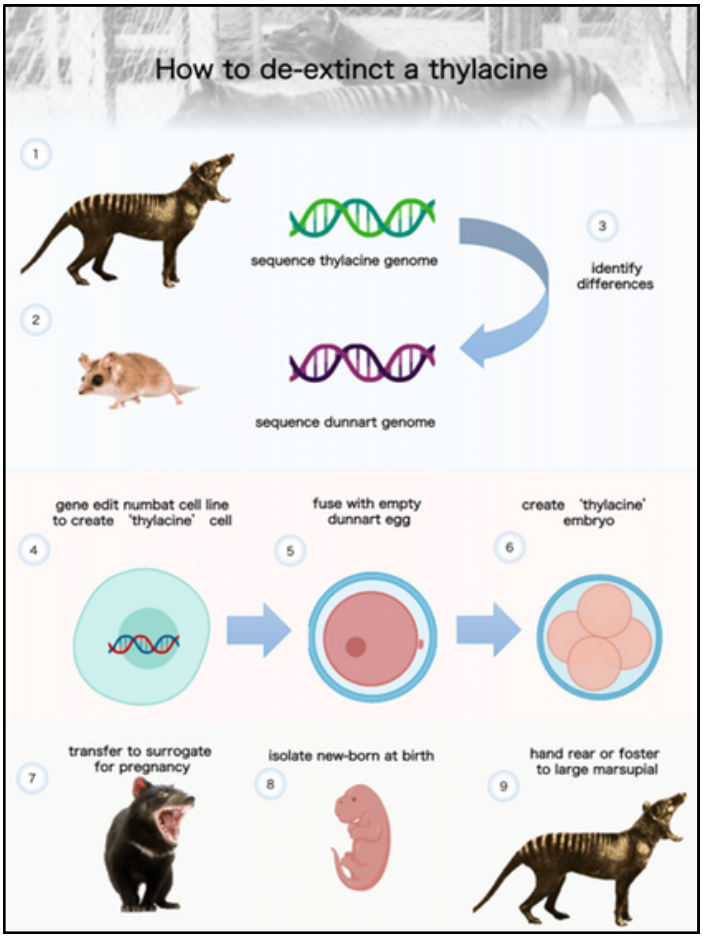
THE FAT-TAILED DUNNART

Want to know more about the thylacine's closest living relative?

The fat-tailed dunnart is one of the smallest carnivorous marsupials which like most primates (and some other marsupials) has trichromat vision. Their diet includes insects such as beetles, spiders, small reptiles, and amphibians. It stores fat reserves in its carrot-shaped tail for times of food shortage. The dunnart itself is often eaten by other carnivores, including invasive foxes and cats as well as other feral animals that live within it's environment. Fat-tailed dunnarts can survive in extreme, semi-arid environments and can be found in most deserts in Australia.

Source: Wikipedia

More recently, advances continue to be made with RNA extracted from a 130 year old thylacine specimen in the Swedish Museum of Natural History in Stockholm just this year! This represents the first time RNA has been extracted from an extinct species (https://genome.cshlp.org/content/early/2023/07/18/gr.277663.123). These results represent the first successful attempt to obtain transcriptional profiles from an extinct animal species, providing thought-to-be-lost information on gene expression dynamics. These findings hold promising implications for the study of RNA molecules across the vast collections of Natural History museums and from well-preserved permafrost remains.



According to the TIGRR lab, the fat-tailed dunnart will provide the living cells and genomic template that will be used to create a functional thylacine genome, and later a complete specimen. The fat-tailed dunnart has "simple and robust husbandry requirements and a short reproductive cycle making it amenable to experimental manipulations." Methods to derive and bank marsupial stem cells have been achieved from the fat-tailed dunnart.

Work is underway to identify the differences (Step 3, see infograph to left) that would need to be edited into the hosts genome to create a 'thylacine' cell. Genome editing of these marsupial stem cells will be performed with techniques like CRISPR-Cas9 to reconstruct the thylacine genome.

Source:
https://tigrrlab.science.unimelb.edu.au/research/

The next steps 5 to 7 require the development of assisted reproductive technologies for marsupials. This will allow the use of living stem cells to make an embryo and then successfully transfer it into a host mother's uterus. "Procedures like enucleating dunnart oocytes to accept material from a thylacine cell, embryo transfer and culture will all be advanced markedly going forward to benefit de-extinction and conservation."

Many technical, ethical and ecological challenges surrounding thylacine de-extinction remain to be solved. Biobanking continues to provide opportunities for research to progress with the hope that one day we may again witness these iconic animals roaming the forests, wetlands, grasslands and coastal areas of Australia.