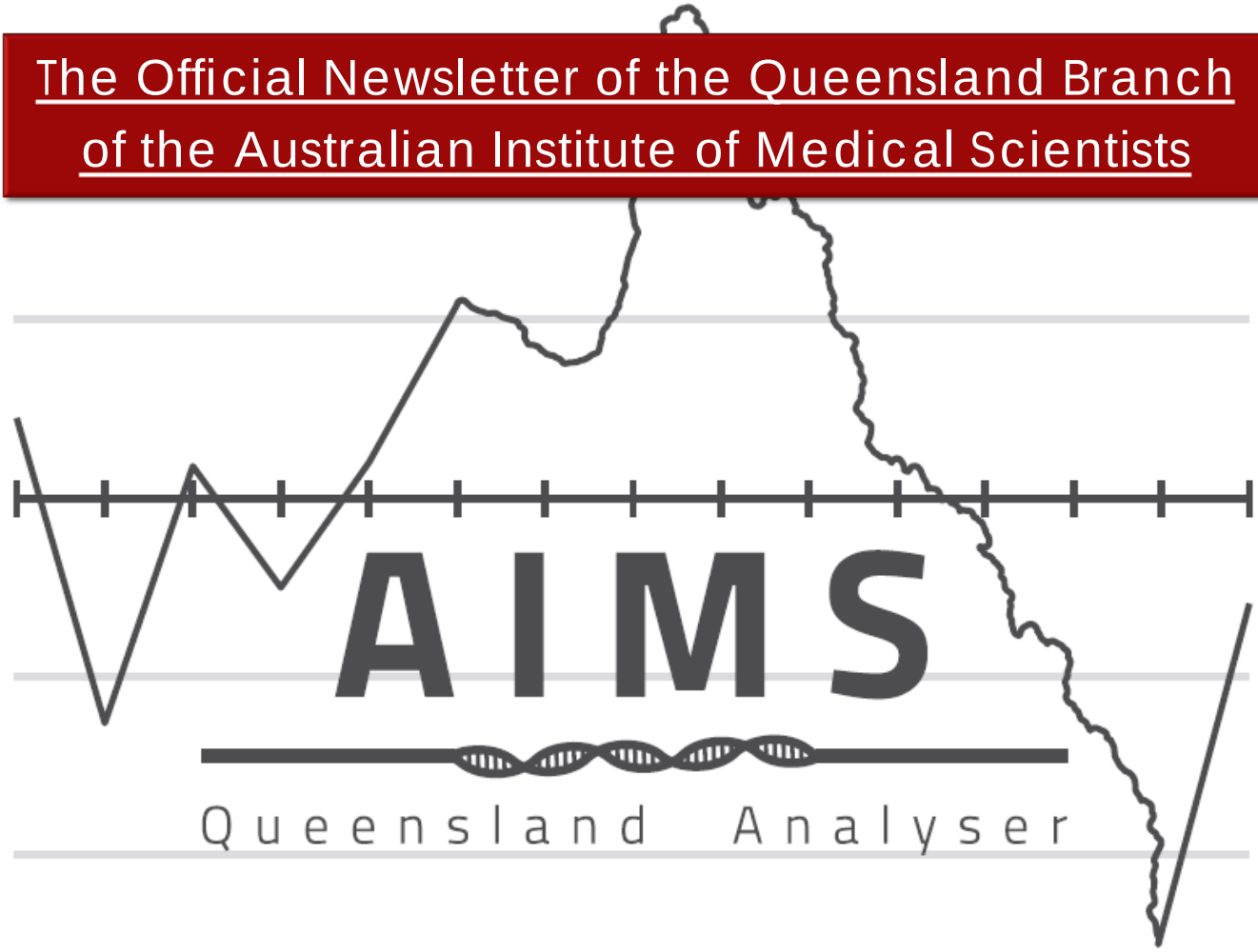
The Official Newsletter of the Queensland Branch of the Australian Institute of Medical Scientists



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AIMS Qld Branch Committee Members 2018/2019

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Committee Member: Deborah Orr (PaLs)

Student Members: Wendy Walker & Jarod Edgeworth (QUT)

Arthur Colquhoun & Andre Jones-Dorr (Griffith)

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Chair's Report

Chair's Report

Welcome to the *Queensland Analyser* mid-year issue for 2020. It has been a challenging year so far. COVID-19 pandemic came upon us and changed everyone's life whether we ae working in laboratories, hospitals or teaching and training institutions. Our scientists, technicians, and phlebotomists as well as pathologists have been at the front line. The media has not given enough credit to our heroes behind the scene, but we all know and pat ourselves and each other on the back for providing selfless service in very high-risk environment. Very proud of all our laboratory colleagues. Being essential workers and many parents with kids studying from home, this period has provided some family time together which brought smile on some kids faces and made others anxious due to the high risk of infection.

Due to need for social distancing and restrictions on movements, we had to postpone some of our proposed activities and plan to have some online meetings until Government and Health Services give all clear

Since last newsletter late in 2019, we look back and review our combined meeting with the Australasian Association for Clinical Biochemistry (AACB) which last year had a theme of 'Assay Interferences', on 22nd October 2019. It was another great night, and I would like to extend our thanks to AACB Queensland Chair Steven Weier and the Committee for their continuing support. More recently, on 13th August 2020 we saw about 70 people attend the annual HGQ-AIMS combined scientific online Zoom meeting on Lung Pathology. We would like to thank Abacus for sponsoring this event. Later in the year we look forward to combined online meeting with AACB in October 2020. We would like to get suggestions from the audience about the themes and topics for future meetings.

In one of the regular features of this newsletter '5 minutes with' we introduce you to Katie Ziegenfusz. Katie has been an AIMS member for several years and is closely involved with Anatomical Pathology. We also thank Griffith University BMLS student, Andre, for preparing our article on pages 12-16, and encourage all other members (again, including our Students and PaLs members) to get involved and contribute by sending us case studies or articles. We are happy to include more than one each issue if multiple come in.

It was also good to see BMLS students from third or fourth year of universities involved in supporting Queensland Health with COVID-19 workload. Whether they were involved in direct testing or supporting the scientists conducting the testing. There is a small blurb included in this newsletter from some of the students feeling proud of their small direct or indirect contribution.

Indu Singh
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Queensland Branch Events Update

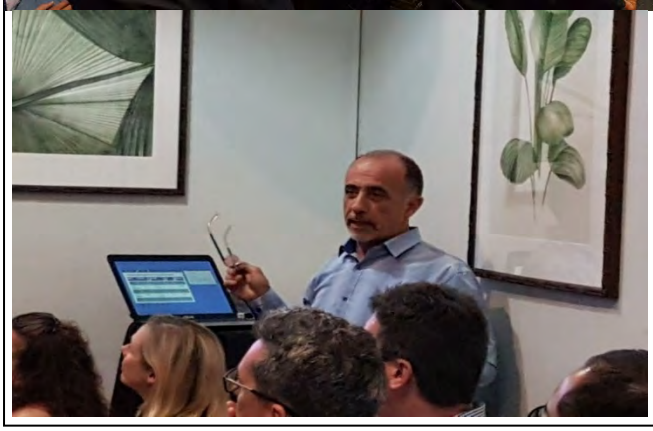
AIMS & HGQ Combined Scientific Meeting August 2019

The annual AIMS and HGQ combined scientific meeting for 2019 was successfully held again at the Pineapple Hotel in Brisbane. The theme for this meeting was Liver Pathology presented by three speakers. Dr Kayla Tran (TPCH, Anatomical Pathology) shared “Interesting Liver Cases”, Dr Gautam Rishi (IHBI, QUT) spoke about “Genetic Modifiers of Iron Overload and Identification using NGS” and Jo Beggs (Supervising Scientist, Queensland Health) presented on the topic “Maintaining the Balance”

The fully packed room included participants from labs such as SNP, QML, The Prince Charles Hospital, The Princess Alexandra Hospital, Gold Coast University Hospital, as well as academics and students from Griffith University and Queensland University of Technology. Special thanks to Trajan for sponsoring the event and Jerres Alcober (President HGQ) and the HGQ colleagues for organising and making the event a great success.

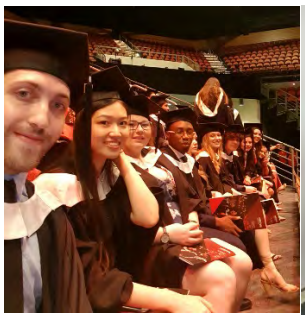
AIMS & aacb Combined Scientific Night

The annual AIMS Queensland State Branch and aacb combined scientific meeting for 2019 was successfully held again at the Plough Inn in Brisbane. The topic for the 2019 scientific meeting was "**Assay Interferences**". Mr Goce Dimeski from Princess Alexandra Hospital was the first speaker of the night. In his topic ***"Interferences with high-sensitivity troponin assays",*** Mr Demiski discussed the clinically significant interferences that can occur with testing high-sensitivity troponin assay. The next speaker, Dr Robert Smith from Diagnostics Clinic of Genomic Research Centre at Queensland University of Technology presented his topic ***"Pitfalls in diagnostic sequencing"***. Talking about his topic, Dr Smith has presented the common errors that many occur while genetic sequencing. The evening continued after the presentations, with the attendees networking and catching up with each other, as food and drinks were being served. Overall, the AIMS and aacb combined scientific meeting for 2019 was a huge success, as the fully packed room included participants from labs such as SNP, QML, The Prince Charles, The PA, GCUH, as well as academics and students from Griffith University and Queensland University of technology. We would also like to thank all the speakers, Steven Weier (QLD Branch Chair) and the aacb colleagues for organising and making the event a great success.



Griffith University Medical Sciences Student Award Night

Griffith University School of Medical Science recognised outstanding achievement of the 2019 graduates of the Bachelor of Medical Laboratory Science program.


Now on to real life challenges, Griffith University 2019 Graduate Scientists.

The Griffith University School of Medical Science awards were held at Gold Coast Exhibition and Convention centre following the graduation ceremony. Students were awarded by the Head of School Prof Mark Forwood. Braden Dowling was crowned the all-around Dux of Class with top grades in Clinical Biochemistry, Haematology, Histopathology and Transfusion Science. Michelle Wu shared Transfusion top place with Braden. Tahlecia Gallagher obtained top marks in Clinical Microbiology and Clinical Placement. Nathan Kearns excelled in the Research project course.

The response to COVID-19, Not All Heroes Wear Capes.
Written by Anna Alistair

In late January COVID-19 had presented itself in Australia. On the 30th of January, the Gold Coast was the second city in Australia to confirm a positive case. Nobody knew life as we knew it, was permanently about to change.
February continued and more cases of COVID-19 appeared. Fever Clinics were established overnight and Queensland were leading the way with rigorous contact tracing procedures implemented and affected patients including Tom Hanks and wife Rita Wilson, being treated, and released from hospital. As March was beginning Australia was instructed to stay inside and not leave home unless it was medically necessary. By midnight, March 18th Australia's borders were effectively shut.
Medical Science students across the country heeded the call to defend Australia against COVID-19 by stepping up to roles in hospitals, medical laboratories, and testing clinics. For Griffith University Gold Coast School of Medical Science students this was no different. Anna Alistair, and six other Griffith University students were given the honour of answering the phones at Pathology Queensland Herston and spreading the positive news of a negative result. Three other students from this cohort were involved in the testing laboratories.

One test that many Queenslanders were happy to fail.
COVID-19 Contact Centre
The COVID-19 contact centre has provided a powerful service to Queenslanders who have required confirmation of negative results to return to school, work, essential travel, medical appointments and most importantly their families. The confirmation of a negative result also comes with immense personal relief who have responsibly self-isolated while awaiting results. Griffith students Sarah, Anna Alistair, Georgia Mataira, Jade Graham, Akarsha Bhola and Katyna Geurens have received enormous praise for their daily efforts and professional manner.

"I encourage you to drop in and listen to how professional these folks are, and pass on your appreciation, I think they are amazing" - Bob Partridge, Pathology Queensland Regional Operations Manager.

Outstanding contributions have been made by each member of the COVID-19 contact centre, giving some thoroughly unique experiences. Here are some of the Griffith University third- and fourth-year student's comments.

" *It's great to see the collaboration of pathology QLD working with the people of QLD to get their results back to them in a timely manner, Emma our supervisor here is great, and super supportive, we also have a great team of easy going people to work with. The main joy of the job is being helpful, we are able to work through many issues with patients and parents to get their lives back to normal after receiving their negative COVID results, and also being able to advise other patients on how they can follow up their results if they weren't done through Pathology QLD.* " Georgia Mataira

"Working for Pathology QLD has been an enriching experience. I have learnt a lot about sample processing and packaging. I have also had the opportunity to help non-English speaking patients by translating their results from English to Hindi.

Helping patients is such a fulfilling experience and I am grateful to Griffith University and Pathology QLD for giving us all this golden opportunity." Akarsha Bhola

"When the COVID-19 outbreak was initially labelled a pandemic, I felt incredibly helpless knowing that I was just shy of being qualified and therefore couldn't contribute to the medical response. I began looking for volunteer positions on the World Health Organization and other local organizations until I was recruited by Pathology Queensland. Working for Pathology Queensland in their COVID-19 response has been an incredibly rewarding experience. Being able to provide support to patients under the stress of anticipating their result and consequently being isolated from their partners, children, and even terminally-ill family members and friends in the meantime, has given me even more empathy and has further confirmed for me that I'm in the right field of work. I'm eternally grateful to Pathology Queensland for this opportunity." - Katyna Geurens

"Working in the COVID-19 call centre has been extremely rewarding. It's an amazing feeling when we come across a patient in a difficult situation and are able to find a way to deliver their results and get them back on track for everyday life, especially work. Isolation after taking a test can be very stressful and can impact someone's life more than you may think. It is awesome to look back and think of how many tough situations we've helped people through by providing this service for them." Jade Graham

"*Working at Pathology Queensland has presented a real opportunity to learn and practise in our respective field of study. Working in the COVID contact centre has engaged me with the true importance of medical diagnostic testing in our community and our world."* Anna Alistair

Floc Swab Squad

Testing is essential to ensure that all new cases are identified and treated. Griffith students have been involved in the production of 35,000 FLOC swab testing kits which have been sent around the state. The procedure involves aliquoting PBS into 35,000 conical tubes, labelling them, and placing them in a biohazard bag with a sterile FLOC swab. Completely clean and sterile conditions were required to put together these vital testing kits. The new FLOC swabs are smaller and less likely to cause nose bleeding and discomfort. This production was urgently required as the increased demand for similar kits have created a shortage in factory produced kits.

Point of Care Testing (Afrael Eby)

In Statewide Point of Care Testing at RBWH, I was tasked with managing the programming and dispatch of portable blood analysers, known as i-STATs, to COVID wards in hospitals and rural health facilities. This provided me with the opportunity to learn a range of valuable skills that allowed me to successfully orchestrate the implementation of these i-STAT analysers in health facilities. As i-STATs are a point of care device that can measure most laboratory tests, they were instrumental in helping health professionals make a provisional diagnosis in a very short timeframe, ultimately improving patient outcome.

Courier driving and sample packaging (Sabrina & Walid El Moussa)
Across QLD countless thousands of specimens are delivered every week to RBWH, Griffith University students Sabrina and Walid have been instrumental in reducing the turnaround times for COVID results. Samples also need to be packaged correctly to ensure safe and reliable transfer of patient samples; Griffith students have played a big role in sample packaging in the darling downs area. Once more labs, such as Toowoomba, are COVID testing capable with new analysers, this will help alleviate the burden on the major laboratories. Until then, the couriers are necessary to transport these specimens daily to quickly identify and contain new cases in Queensland.

Administration (Anna Alistair)
Working in Central Administration, I had the duty of speaking with many Doctors' and medical staff involved in all aspects of patient care teams. Ensuring the transfer of pathology results in time for medical appointments in treating rooms and hospital operating theatres is a vital part of the health care service.

Some of the many students at Pathology Queensland helping with the COVID-19 workload

Note on Student Membership Application Forms

The one-page form is currently for full-time students only and has to be signed by the Course Coordinator or an officer of the university. The two-page form is for all other applicants. Both forms are available at http://www.aims.org.au/membershipinformation/join

The **APACE** (**Australasian Professional Acknowledgement of Continuing Education**) scheme is a voluntary programme that recognises continuing education, formal courses and a wide range of professional activities which contribute to your professional growth.

The healthcare industry is undergoing rapid change. We are expected to keep our knowledge and skills up to date to enable us to perform to the highest professional standard. The **APACE** scheme provides a method by which your professional activities are recognised.

APACE has been approved by the **New Zealand Medical Laboratory Science Board** as a re-certification programme for **New Zealand Medical Laboratory Scientists**.

APACE has been approved by the **Royal College of Pathologists Australia** (**RCPA**) as a continuing professional development recognition programme for Fellows of the Faculty of Science.

For more information and to enrol visit http://www.aims.org.au/apace

'5 Minutes with Katie Ziegenfusz'

1. Where do you work?
   I am the Assistant Laboratory Manager for Anatomical Pathology at Sullivan Nicolaides Pathology in Brisbane.
2. What do you like best about your current position?
   My current position has me doing a vast array of tasks, both scientific, workflow, HR and strategy. The variety means no two days are the same and I never get the opportunity to run out of work. My 'upbringing' as a scientist in one of the busiest and largest immunohistochemistry labs in Australia means that I don't cope with boredom easily – if I'm not running like I'm on fire then I'm not having fun!
3. Do you believe that there will be any lasting changes to the Pathology industry in the post Covid-19 world?
   I think there will be an ongoing appreciation for the volume of work that we do and busy will never be taken for granted again. Prior to this pandemic there was an ideology that pathology was bullet proof and our work was a guarantee – I believe the reduced work and fragility of the industry will make us view our work with a greater sense of appreciation.
4. What future development/s direction/s in the industry are you excited about?
   The ongoing collision between Molecular Pathology and Anatomical Pathology. Gene targeted therapy is exciting and I am excited to watch where it goes. Also, liquid biopsies.
5. What motivated you to begin, and what has been the best thing you have learned on your AIMS fellowship journey?
   I was motivated by the desire to increase my knowledge and capability as a scientist. I also wanted to give myself a good educational springboard by which to achieve a management position and illicit change. The best thing I have learned from my fellowship is greater insight into what I DON'T know. Only with learning and education have I learnt how much I have to learn.
6. If you could choose to have any superpower, what would it be and how would you use it?
   The power to make my children pick up their bath towels off the floor of an evening? Or a work one – the power to predict workflow? Can I have both – both would make my life infinitely better!

The Genetics of the Woolly Mammoth Extinction and De-Extinction

Written by André Jones-Dorr and Emily Appleby

Introduction:

Mammathus primigenius, more commonly known as the woolly mammoth, was an ice age herbivore which became extinct 4,000 years ago. Since its discovery, it has quickly grown into one of the most widely recognised species of the prehistoric period. Its closest living relative is the Asian elephant and whilst the two, show remarkable phenotypic similarities, there are numerous genotypic distinctions which allowed the woolly mammoth to adapt to the frigid temperatures of the Arctic tundra. It was once considered impossible to resurrect this species, however, advances in genetic technology may yet facilitate an incredible scientific phenomenon – the return of the woolly mammoth.

The Extinction of the Woolly Mammoth

The Woolly Mammoth was a specie of Mammoth that existed and was well-adapted to Ice-age conditions. The Pleistocene Epoch, or colloquially referred to as the 'Ice-age', was marked by the expansion of the continental and polar ice sheets; that glaciated Europe, Asia and North America. These mammoths grew 3.4m tall, weighed 6 tons, capable of consuming 340kg of vegetation daily and where covered in thick brown fur had extensive adipose to insulate small extremities such as the ears, trunk, and tail.

Evolution:

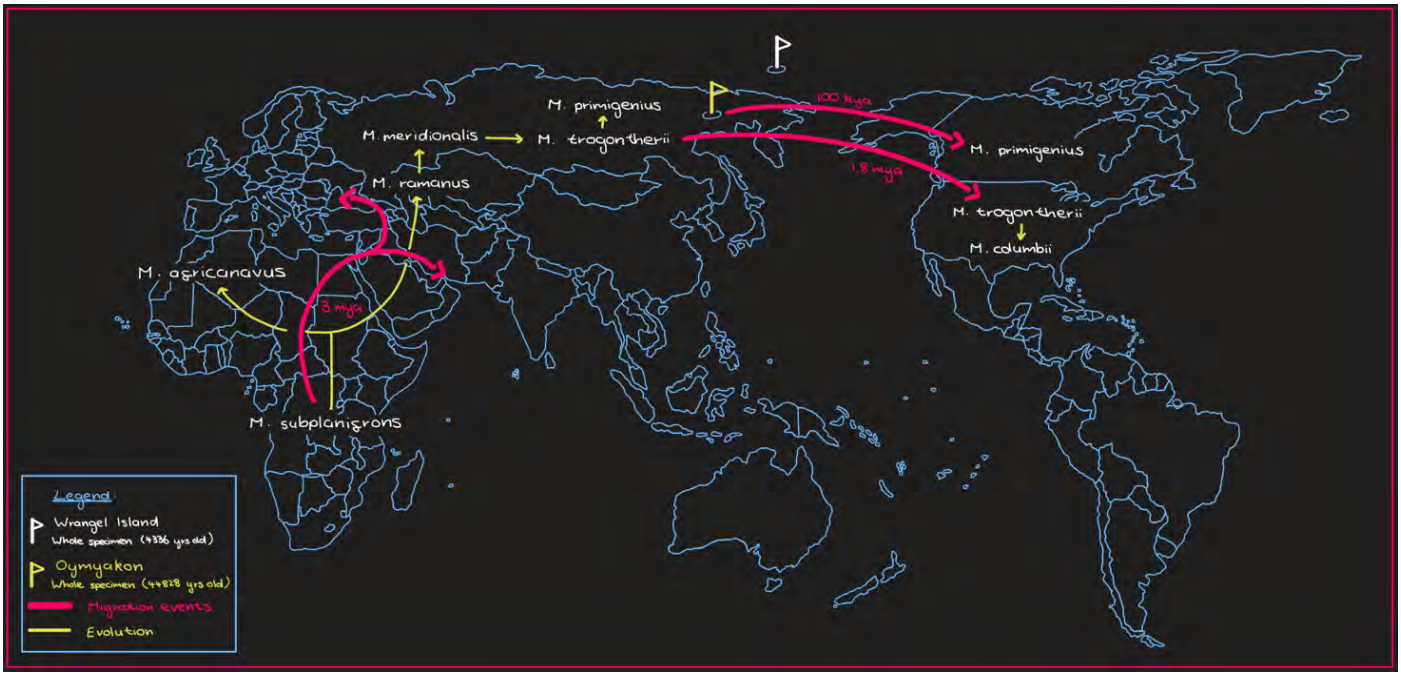
Through fossil records, the migration and evolution of the mammuthus species has been tracked. It can be seen through millions of years of migration, that the Mammuthus species migrated out of Africa and into the Northern Hemisphere. It was not until 400,000 years ago that the Woolly Mammoth came into existence, from a speciation event with a Siberian-Based, Mammuthus Ancestor.

Through 3.5 million years of evolution, the Woolly Mammoth became highly adapted to survive in the Siberian landscape. In a 2015 study, these adaptions were traced back to genomic level, by comparing the genomes of three Asian elephants to two woolly mammoths. Overall, there were 1.4 million differences in the nucleotide sequence identified, effecting the expression of 1600 proteins. Difference were noted in genes that encoded for the development of the metabolising adipose, perceiving temperature and most notably haemoglobin regulation. Woolly Mammoths are thought to regulate haemoglobin concentrations to conserve heat and oxygen circulation. The study identified 3 substitutions (T12A, A86S and E101Q) on the HBA-T2 gene for alpha Haemoglobin in woolly mammoths. These mutations were consistent with other mammals such as reindeer and muskoxen that originate from similar latitudes.

Extinction:

Although the Woolly Mammoth was a well-adapted specie, most of the population disappeared 10-50,000 years ago. Larger mammals like Mammoths are generally more vulnerable as they have smaller population sizes and reproduction rates. There are two theories surrounding their extinction; hunting and climate change. It was though early hominin civilisation could have hunted the mammoths to extinction. Although not implausible, there was rich documentation and cave-illustrations showing early humans living in symbiosis with the mammoths. It is more likely, that the rising atmospheric temperatures caused the mammoths demise.

Climate change is thought to have led the woolly mammoths to extinction because of the rising atmospheric temperature. Ice-core samples have shown that the mean atmospheric temperature of Siberia rose from -7°C to 2°C, reducing the habitable area 89.61% from 7,700,000km^2 42,000 years ago, to 800,000 km^2, 6 thousand years ago. The loss of habitat directly reduced the mammoth's population, leading to a bottleneck. DNA sequencing has confirmed this by investigating the genome of the Wrangel island mammoth. The Wrangel Island Mammoths were the last surviving mammoths, going extinct 4,300 years ago. These Mammoths were isolated for 5,000 years from the mainland by rising post-ice-age sea levels. This resulted in inbreeding in their already small population of 300-1000 individuals. The inbreeding leads a 30% loss of



A migrational map illustrating the evolution of the Mammuthus Genus.

The Genetics of De-Extinction

Since the Woolly Mammoth has been extinct for the last 5,000 years, how is it possible to “de-extinct” the specie?

A portrait of Dr. Gorge Church

It was originally thought that the woolly mammoth could have been revived by cloning, as in Dolly the sheep. Cloning involves the duplication of DNA, forming an identical creature. However, it is impossible to clone mammoth DNA. The DNA of mammoth specimens has inevitable degraded from UV exposure and post-mortem metabolic processes whilst frozen in permafrost. The degradation causes gaps to form in the DNA sequence, forming fragments that are usually less than 100 nucleotides long. Sequencing results in incomplete genomes, preventing any hopes of cloning and the revival of the woolly mammoth. There has been previous research in the past, conducted by the Chinese and Russians investigating similar nuclear transferase processes, but all have failed. However, there is hope…

Harvard geneticist Dr. Gorge Church endeavours to create elephants that have mammoth derived adaptions to the cold climate. Church has already succeeded in editing the genomes of the mammoth’s closes living relatives, the Asian elephants. His team has made 42 modifications at 14 loci for genes such as the HBA-T2 alpha haemoglobin gene and others for polygenetic traits such as ear size, subcutaneous fat and hair. Church has made these transformations using genetic engineering technology, CRISPR Cas 9. CRISPR Cas 9 is a highly accurate, sensitive and reliable method of performing insertions or deletions of DNA to activate or install new genes or even remove or deactivate genes.

To make these elephant-mammoth hybrids, Church has employed a five-step model:

1) Initially, Church extracted, sequenced and assemble the most accurate genome from several well-preserved specimens from Wrangel island and Siberia. He then compared this genome to the Asian elephant, identifying regions where sequence diverged. Overall 99.96% of the genome was identical, with only 2,020 nucleotide substitutions, effecting the expression of 1600 proteins. Church used these discrepancies as genomic markers, to guide the modifications made in the elephant.

2) Secondly, Church synthesised guide RNA from the regions that required modification in the Elephants genome. Guide RNA is used to direct the Cas 9 protein utilised in CRISPR. Cas 9 is a multifunctional enzyme that is able to recognise, unwind and cleave regions of DNA that are identical or “homologous” to the guide sequence.

3) Once the guide sequence is formed, CRISPR can be employed. When the Cas-9 complex recognises and binds to a short sequence of DNA adjacent to the target site. This initiates a helicase enzyme to unwind the DNA, allowing the guide RNA to pair with the homologous target sequence. If the sequence pairs precisely, Cas 9 uses an endonuclease enzyme to lyase the DNA, making a double strand break. Modifications to the genome can then be made, by effecting the DNAs natural repair pathways.

   Insertions in the DNA sequence can be made in Homology Directed Repair (HDR). HDR anneals the broken ends with a homologous DNA template. The DNA template has region is composed is composed of two regions; the gene region and the sticky ends. In the gene region, new nucleotides sequences can be to add to the genome, thereby replacing the faulty DNA sequence or even inserting a new gene. The sticky ends are homologous to the DNA cut site, allowing the sequence to anneal.

   Deletions in the DNA sequence can be made in Non-Homologous End Joining (NHEJ). NHEJ ligates the broken ends without the need for a homologous template. Since the template may not be homologous, adjacent base pairs can be deleted, potentially causing gene inactivation or correction.

4) Next, the recombinant genome is sequence to see how effective the deletions and insertions CRISPR made were. This is the stage Church is up to. He is still perfecting the genome before proceeding to step 5.

5) Step 5 involved transplanting the recombinant genome into elephant fibroblast cells. The fibroblast cells will be induced to pluripotent stem cells through chemical reactions. The stem cells can then be implanted into a surrogate Asian elephant, which be used to gestate the foetus. The newborn elephant-mammoth hybrids will be raised in a wildlife sanctuary in Siberia. Gorge plans the first-born mammoth is only 4-5 years away, with 24 months of gestation. However, there is still significant challenges, like how many chromosomes did mammoths have?

The Ethical Considerations

There are numerous ethical considerations with regards to the re-introduction of an exotic creature which has been extinct for many thousands of years. One of the arguments for Dr. Church's research is that a large population of mammoths may slow arctic melting though these simulations are often rebutted as biased. Additionally, 'de-extinction' of an animal species, may introduce a careless attitude towards current wildlife. There is an ongoing debate between use of a surrogate mother and artificial womb in light of accusations of animal cruelty. However, this necessitates re-creation of all the biochemical stimulants

There is, however, one overriding factor which is the sheer magnitude of the genetic phenomenon that would be the return of the woolly mammoth. This is a particularly important milestone given the prediction that 50% of mammalian species will be extinct by the end of the century. Furthermore, simulations have predicted not only that re-introduction would promote absorption of greenhouse gases but also that prevalence of elephant herpes might decrease which is currently responsible for 80% of elephant deaths. Finally, though it is dependent on the success of current research, use of artificial wombs is a cutting-edge field with the potential for application to the woolly mammoth.

Conclusion:

Although mankind has not known the presence of the Woolly Mammoth for many thousands of years, there is still hope. Dr. George Church with his development of the elephant-mammoth hybrids using CRISPR Cas 9 technology aims to revive the Woolly Mammoth in all its former glory despite numerous ethical debates and set-backs. Beyond the likelihood of poaching and the detriment to current species … Even beyond the revolutionary monument that is the revival of the woolly mammoth, there exists a simple question – **why stop there?**