



ACTHA contact details
PO Box 160
Jamison ACT 2614
E-mail: info@actha.org.au
Website: www.actha.org.au

ACTHA Inc. News

Feb - Mar '17

*Newsletter of the
ACT Herpetological
Association Inc.*

Your Committee for 2016 - 2017

President	Scott Keogh
Vice President	Ric Longmore*
Secretary	Dennis Dyer
Treasurer	Margaret Ning
Newsletter Editor	Mandy Conway
Webmaster	Angus Kennedy
Public Officer	John Wombey *
Excursion Officer	Mandy Conway
Conservation Officer	Joe McAuliffe
Committee Members	Jason Spurr Iris Carter Greg Flowers Roy Chamberlain Peter Child
Student Representatives	Vacant

* Denotes Life Members



*Above: a Lace Monitor, *Varanus varius* on the left and
a Rosenberg's on the right: last seen at Snakes Alive!*

In this issue

Snakes Alive! 2017, a photo-filled overview
begins on page 2.

Rosenberg's Monitors on Mt Ainslie:

She's Back! turn to page 8 for the latest
sightings of Rosie and a new female, Roxy.

A trio of Herps spotted in Murrumbateman,
page 9.

The Australian & International Scene:

The contentious Ellerton Drive Extension,
Qbyn, page 10.

How snakes lost a blueprint for making limbs,
page 11.

Diary date

The *bi-monthly* meetings of the Association are usually
held on the **third Tuesday of the month**
at 7.30pm. Our usual venue is:

Belconnen Soccer Club, Hawker
(cnr Belconnen Way & Springvale Drive)

Upcoming meeting

Tuesday, 21 February 2017

Bruno Ferronato, UC, will be our first guest
speaker and he is going to give an overview about
his trip to the World Congress of Herpetology in
Hangzhou, China in Sept '16: "**An overview of
turtle conservation and management in China**".

Damien Esquerré, ANU, will follow Bruno
with an Indonesian photo slide show which
includes "**awesome herps like king cobras,
Malaysian kraits, pit vipers... and of course
Komodo dragon!**"

This presentation will be particularly appealing to
our younger members, both presentations are a
must attend, see you all there!



Snakes Alive! Exhibition 2017

Several ACTHA members have penned their thoughts about this year's event which, combined with photos taken by several members, summarise the 7 days beautifully.

From Dennis Dyer

Snakes Alive! 2017 was conducted over seven days from 16 to 22 January, again at the Crosbie Morrison Building, Australian National Botanic Gardens (ANBG). It was a successful event which fulfilled the Association's aims of educating the general public about the importance of herpetofauna in the environment. The theme this year, as displayed on the publicity posters, was 'Conserving, breeding & keeping native reptiles & amphibians'.

Overall, the display included 24 'resident' reptile and amphibian species, with other individual animals provided for specific feeding sessions. The preceding week saw Margaret and I spend many hours carrying out preliminary work, assisted by other members, many of whom also who provided their animals for display, feeding and handling.

As previously, the display was set up and dismantled by Peter Child, Paula and Derek Child and his assistants and this year occupied the three public rooms at the Crosbie Morrison Building. The main room was arranged with glass enclosures around the perimeter with easily handled skinks in the centre.

One feature was the tank containing two baby long-neck turtles being positioned at the entrance of the display (the turtles would normally take up space in the centre of the room), allowing visitors more space when viewing the feeding sessions or other activities. The intermediate room included aquarium tanks for a freshwater crocodile and a pig-nosed turtle, green tree frogs and a very active legless lizard. It also hosted a recently amended continuous slide presentation of local herpetofauna prepared by Geoff Robertson.

As in past years, the small room at the back of the main area was allocated to display local endangered and threatened species. This included Corroboree frogs lent by the ACT Government, a green and golden bell frog lent by Ginninderra Catchment Group, striped legless lizards from the Australian National University and gearless dragons lent by the University of Canberra.



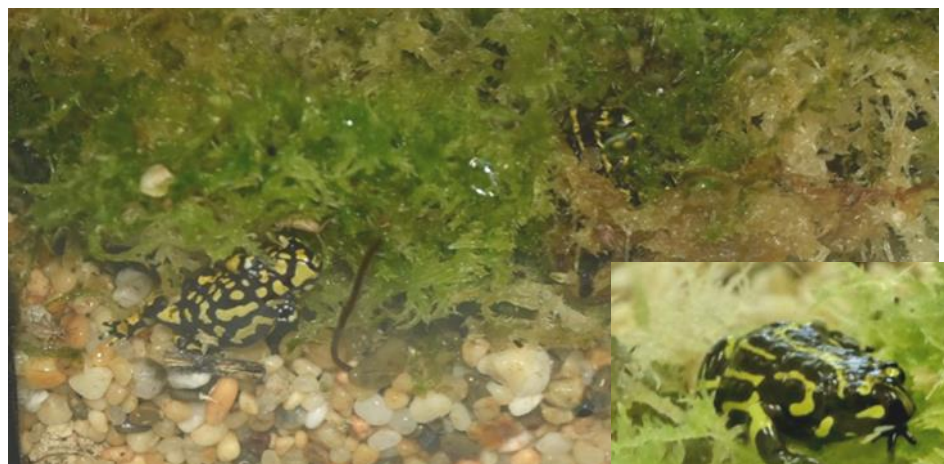
Dennis with a Bredli python enjoying lunch.

Image: Alison Gee



Image: Lucinda Royston

Geoff misting the Corroboree frogs.



Images: Lucinda Royston

(*Snakes Alive! 2017, cont'd,...*)

Feeding sessions were held each day at 11am, 2pm and 3pm and attracted large crowds; some mid-day sessions throughout the week were also arranged. The species to be described and fed were prominently displayed on a white board in the main room and the python 'feeding tree' once again proved popular. Many groups of students and their supervisors from holiday programs, mostly conducted by the YMCA and organised by Margaret, came along and provided attentive and excited audiences for feeding and other sessions.

This year the raffle also went well, with profits and donations to be provided towards Herpetofauna research.

Again the ANBG organised the publicity as well as the wonderful venue and facilities and local radio station 2CA provided continuous mentions of the event. Geoff Robertson, Ric Longmore and I attended a live radio interview on 666ABC where Ric's woma python was the star attraction, spending most of the interview time around Laura, the interviewer's neck. Also, for the first time, a sandwich-board advertisement was placed on Clunies Ross Drive in the vicinity of the entrance to the ANBG. 'The Canberra Times' provided a free advertisement in their Saturday's edition too.

For the first time facilities were made available to pre-book entry to the Exhibition using the internet and visitors were able to pay using credit cards.

The usual Wednesday evening Get-Together took place to celebrate what was a most successful display.

Mention must also be made of those members who provided their time and enthusiasm in manning the entrance, the shop and selling raffle tickets. It was great to welcome some new enthusiastic *Snakes Alive!* volunteers this year, from the younger generation in particular.

From Lainey Ford (left)

"My favourite thing about *Snakes Alive!* was talking to Joe about Stimson python care and he taught me how to pick up a python and what to feed it and about the enclosure care. I really enjoyed talking to Joe at *Snakes Alive!* I also liked talking about different reptiles to people and showing my lizard Treasure."



Image: Alison Gee

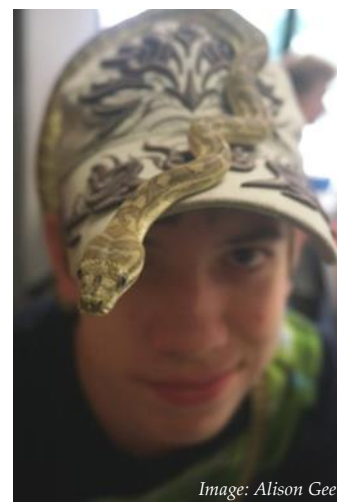


Image: Alison Gee

Peter and friend!



Image: Lucinda Royston

Anam and his Lacy, with Connor and Angus



Shahzad with his beardy Gandolph, and then a jungle python



Images: Lucinda Royston



Images: Lucinda Royston



Image: Lucinda Royston

(*Snakes Alive! 2017, cont'd,...*)

"I liked going to the [ANBG] pond to look at the lizards and turtles and tadpoles and going to the cafe to get food and going to the book shop to buy another new reptile book. My favourite snake we had there was also my favourite out of all of the snakes. The Stimson Python! I felt like jumping up and down when I found out there would be one at *Snakes Alive!*"

From Alison Gee

"Another great week of *Snakes Alive!* This is only the second time Lainey and I have been involved but we love it! It is exhausting at times but we are happy to lend our hands to this wonderful event. Besides, a quick milkshake works to perk up our energy. It is something special that I share with my daughter to support her interest and I admit that I have been converted to the world of reptiles by her enthusiasm. We always learn so much during *Snakes Alive!* and my daughter loves talking to other people to get interesting facts and tips on care. Thanks to all the wonderful people who share so much of their knowledge and animals during the week."

From Helen Moffatt

"Peter and I had a great time helping at *Snakes Alive!*. For Peter, he enjoyed seeing his reptilian friends again: Fluffy (goanna), Fingers (python) and Crowley (python). He enjoyed interacting with the public and showing them how to handle the snakes and lizards; and helping with the shop. For me, I enjoyed working with Lucinda at the ticket desk again, and seeing how Margaret's new finance app speeded up sales and provided end of day data. I found that as exciting as watching the pythons get fed!"

From Geoff Robertson

Snakes Alive! had another successful year and over 2500 visitors went away with smiles on their faces and a better understanding of our herpetofauna. Over the last 30 years there have been almost 100,000 visitors to our annual display and that, plus the enthusiasm of those putting on the display, has brought about a more positive attitude to herpetofauna in the Canberra region, and the recognition of the need to protect wild populations.

Each year many people visit for the first time and we see the scales drop from their eyes as they realise the important part played by local herpetofauna in ecology and appreciate the inherent value and beauty of each species. It is amazing how much excitement is expressed by people when they see a python strike and wrap itself around its prey, and then open its jaws as it begins to consume a meal much bigger than its head.

While reptiles are not known for being touchy-feely animals, people are often transformed by their close experience with touching and holding our snakes, blue tongues and bearded dragons. Tireless hours were put into this activity by Ali, Alisdair, Anam, Angus, Ben, Beth, Dennis, Greg C., Iris C., Jake, Kay, Lainey, Mark, Peter, Roy, and Shahzad.



Images: Lucinda Royston

Blue-bellied black snake



Image: Lucinda Royston

Water dragon



Image: Alison Gee

Woma python

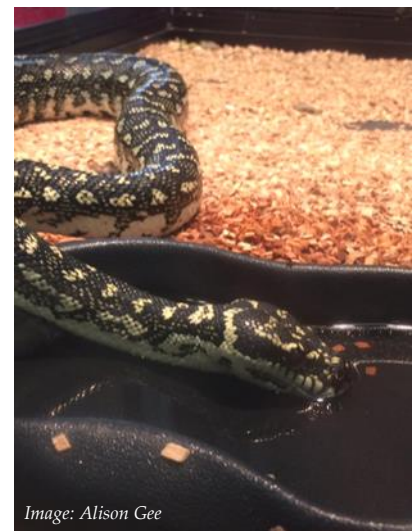


Image: Alison Gee

Diamond python

(Snakes Alive! 2017, cont'd,...)

The many people who visited the '**threatened species room**' were delighted to see the Corroboree frogs, grassland earless dragons, striped legless lizards and green and golden bell frogs - all displayed well. They were fascinated to discover how legless lizards differ from snakes, to hear how chytrid fungus has all but wiped out the corroboree and green and golden bell frogs which were once as prevalent as cane toads, and to hear of the attempts through captive breeding programs and translocation to reintroduce these threatened species into their former habitats. It was also a good opportunity to remind those attending *Snakes Alive!* that all wild herpetofauna populations are badly impacted by cats and dogs, climate change, and development. There were endless questions of our volunteers who had the opportunity to share their experiences, insights and knowledge of science.

Once again this year, we had many **visitors from school holiday programs**, which resulted in very large numbers at the feeding times. Over 400 young people, along with their educators passed through. We had more feeds and talks than in previous years - we are getting rather good at it, although we ask a lot of our animals and selves to put on this effort. This year we had many star performers - Jake, Joe, Dennis, Greg, Mark, Mandy, Anam, Roy, Peter, Brett and Emma, and a few sessions from me. These were memorable and enjoyable events for the many that heard them. Organising the crowd is always challenging so that everyone can see and hear - there are always one or two children oblivious to those around them that need some gentle manipulation. These talks also provide the opportunity to mention the parlous state of our wild herpetofauna, the reasons why we have *Snakes Alive!*, and the reason why we need financial support for research. Behind the scenes, the feeding program was constantly changed and updated owing to the unpredictability of our animals. Hats off to Dennis for ensuring that we had sufficient animals to feed.

Also once again, Wayne from Wildcare fed a couple of **venomous snakes** (although the Blue-bellied black snake declined the rat it was offered), including giving first aid demonstrations on dealing with snake bite. Greg C. also did a similar snake bite demonstration in conjunction with Jake's first feeding talk.

The front door saw many changes this year as we introduced web bookings, credit card, and new software. All went more smoothly than normal. Also, each of the holiday care groups needed to be counted so that invoices can be sent to them later. Lucinda and Helen did a fantastic job entering people without fuss or muss and selling raffle tickets to **fund Corroboree frog research. (The latter raised over \$700.)** They were relieved each lunch time by Dale and or Iris E. The shop was also well attended by Peter, Lainey, Ali and Connor.

Another interesting contribution was by Greg F. who constructed the 'feeding tree' for the animal feeds. Mandy advised on 'animal health' when necessary.



Image: Lucinda Royston

Green tree frog

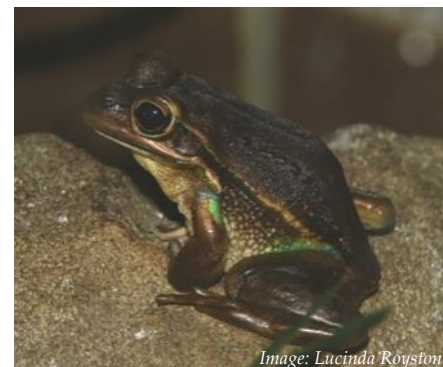


Image: Lucinda Royston

Green and golden bell frog



Image: Lucinda Royston

Fingers python was once again a star!

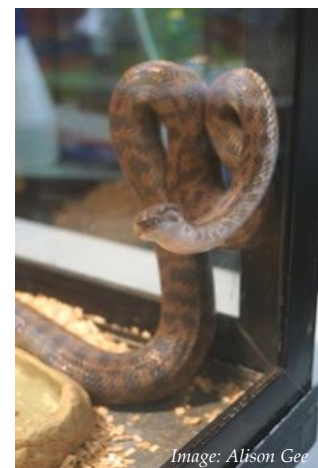


Image: Alison Gee

an acrobatic little snake



Image: Lucinda Royston

a bearded dragon

(*Snakes Alive! 2017, cont'd,...*)

Jo and Joe R. acquired the Aqium hand sanitisers, an essential part of our hygiene efforts, and Helen spruced up our name tags. Of course the whole show would not exist if it were not for the efforts of Peter Child, his parents and his helpers. The setting up was done over a period of a few days, but the packing up was essentially complete a mere hour from our doors closing at 4pm on Sunday. Peter remained on call for the duration of *Snakes Alive!*, which is very reassuring when one considers the huge responsibility of running it throughout the week. A special thanks to him.

The numbers attending *Snakes Alive!* continue to trend down. We had less media coverage, with our best effort on the Wednesday when Ric, Dennis and I were interviewed on 666 on the afternoon program for around 13 minutes by Laura Tchilinguirian. Laura is a gem of an interviewer and she had Precious the woma curled around her neck while questioning each of us on animal keeping and the highlights of *Snakes Alive!* (The 666 interview may still be on the ABC website; <http://www.abc.net.au/radio/canberra/programs/afternoons/snakes-alive!/8191578>) On the other hand we pushed Facebook and encouraged visitors to place their photos on Facebook and to tell their friends.

While not often commented on, my little slide show on the reptiles of the Canberra region churns away in the background. It has been revised many times and used in many talks over the years, as our knowledge of local reptiles improves.

A special mention of Margaret who popped up everywhere and who is the vertebrate of *Snakes Alive!*

My best memories

Many good memories from this event. It was good to speak to each of our young volunteers and to hear of their life plans - what a talented and caring group of people; it was great to see our presenters strut their stuff and get across their knowledge and experience and their tension (would this animal feed or not, will I get bitten if I am not careful); it was good to experience the interest in the threatened species room and a delight to feed the Corroboree frogs; it was good to watch Dennis worry about what animals we might feed and to work with him as we constantly revised the feeding program; it was also good to catch up with old and new friends, including many enthusiastic herpetologists and conservationists - it was great to meet Roy's father-in-law Burgess Cameron who made a great contribution to economics; and it was great to count the money. One fun experience was encouraging some reluctant visitors to handle a blue-tongue only to have it do its business on them.

Margaret writes

I would like to thank our members who volunteered themselves and/or their animals for *Snakes Alive!* including those who were also there for setting up and packing up. With so many focused people offering thoughtful pieces of advice and guidance, everything fell into place beautifully.



Image: Lucinda Royston

Above: Jake does what he does best - handle reptiles and chat with kids!

Below: Wayne feeds one of the venomous snakes.



Image: Lucinda Royston



Image: Lucinda Royston



Image: Lucinda Royston

(Snakes Alive! 2017, cont'd,...)

Thanks also go to Gus and Stephen for their help with the new 'entry' system, and for their patience and perseverance with all aspects of its implementation!! Also, I would like to thank our threatened species providers, the ACT Government, University of Canberra and Ginninderra Catchment Group. We zealously guard our 'threatened species room', as we value the trust placed in us by those supporters, so thank you Greg C., Iris C., John, Rob, Geoff and Tony, for hanging out in the (air conditioned) littlest room in the building.

Spirits didn't flag in the pervasive heat. Five of the seven days were over 30 degrees, including three that were over 35 degrees, and a few mms of rain fell one morning as well. But our troops kept on keeping on.

Our wonderful host, the ANBG, was only ever a phone call away and responded obligingly to all our requests for help over the two week period of setting up and opening our doors.

Some other comments from volunteers on what they enjoyed most

Mark: I admired so many of our volunteers multitasking. Lucinda for example, apart from working on the front desk, also worked on the tub and took lots of photos.

Alison: I love seeing how enthusiastic the kids are when they get to see and touch the animals.

Alisdair: It is encouraging to see how children take an interest in reptiles and ask so many questions. It is also good to see the contrast between some parents, afraid of reptiles, and the children who show no fear.

Dennis. Meeting a young new member and discussing her interests and seeing her enthusiasm.

Peter R.: I liked handling Crowley. When asked why, the answer was, it's just Crowley.

Greg C.: Watching all the kids' reactions when they finally see a Corroboree frog and the surprise on their faces to discover that there were 16 not just 4 frogs in the enclosure.

Joe: long pause, and when pressed, it is probably that everything we do is probably about right.



Image: Lucinda Royston

*Above: shingleback, Eastern blue-tongue and Blotched blue-tongue lizards enjoying lunch.
Below: a pair of Cunningham skinks.*



Image: Lucinda Royston



Image: Lucinda Royston

Two bearded dragons and one Spiny-ridged monitor getting some heat rays from a lamp.

Below: Margaret snapped this brown snake crossing the road near the Crosbie Morrison Building at ANBG. Time to go home?!



Image: Margaret Ning





Image: Matthew Higgins

Rosenberg's Monitors on Mt Ainslie She's back!

Matthew Higgins reports on 31 Jan '17

Yes folks, **Rosie** has returned. (*Images a & b*) taken this morning on Mt Ainslie, at a different mound to last year. Comparison of facial markings confirms her identity. As you can see she's busily digging into the mound - hopefully about to lay eggs and not cannibalising those of another monitor (the hole is awfully big). She looks gravid, so hopefully it is the former. Next visit will tell.

The cycle continues!

More on 5 Feb '17

Further to my recent email about the reappearance of Rosenberg's Monitor 'Rosie' on Mt Ainslie, yesterday I came upon a **NEW** gravid female digging an egg chamber at a mound to the north. As well as seeing the partly excavated egg-chamber in the mound, I located the goanna in the burnt/rotted base of a nearby eucalypt, resting through the 33 degree mid-arvo heat (*image c*). By photographing her face, I was able to compare her facial markings with Rosie's. She is quite different and quite a bit smaller (younger). So, as Rosenberg's are the 'R Series' of goannas, I've named her **Roxanne**, which I trust she and Sting will be happy with!

As for Rosie, she struck a boulder in the mound she was excavating for her egg-chamber and has disappeared. It was while searching mounds within a 1km diameter of her mound that I found Roxanne. I maintain hope of finding where Rosie has got to, though at the moment, as Banjo would have said, 'I don't know where she is'.

And on 7 Feb '17

The recently discovered Mt Ainslie Rosenberg's Monitor Roxanne (or Roxy to those of her inner circle) abandoned her termite mound egg-excavation on Saturday soon after I found her - no doubt due to human and canine disturbance from the nearby walking trail only 15m away (eg I passed a walker with his unleashed dog that evening on the track). I tracked Roxy next day to a new mound further north, a much better camouflaged location which while not completely hidden from hominids and quadrupeds is a spot hopefully evident only to aficionados. She excavated a new egg-chamber during Sunday and yesterday. Roxy laid her eggs in the chamber yesterday evening. Hooray! Another generation of this rare and widely threatened species has a chance.

Choughs (*image d*) alarmed at Roxy's arrival for work yesterday morning (poorly focussed pic but she's visible in the grass below the choughs). This is the second time that bird alarm calls have alerted me to the presence of otherwise almost invisible goannas. Finding goannas is not rocket science, just good old-fashioned bushcraft, plus solid reading in the expert literature, and HEAPS of persistence.

The golden moment (*image e*) Roxy laying her eggs inside the termite mound. Her body gave a small wriggle as each egg was deposited.



b

Image: Matthew Higgins



Image: Matthew Higgins

c



Image: Matthew Higgins

d



Image: Matthew Higgins

e



(Rosenberg's Monitors on Mt Ainslie: She's back! cont'd,...)

(image f) Roxy is now guarding the mound against egg-cannibalisation by other monitors and has followed well in the footsteps of Rosie of 2016 fame (who, incidentally, remains AWOL, though no doubt has found a termite mound unknown to me).

Yours

Goannameister (aka Matthew Higgins)

f



A trio of Herps spotted at Murrumbateman in January '17

Margaret Ning reports on behalf of her friend.

"Today I was whipper snipping near the cottage and I moved a block of wood and there were **three different reptiles underneath**. One was a baby eastern brown about 300mm, another was one of those small garden variety skinks and the third was I think a legless lizard of some sort. You would have been very excited. But they all scuttled off. As did I. Didn't want to risk the snake getting in my boot.

I thought it very odd that these 3 would be under the same block of wood only the size of a dinner plate. Maybe they had all been separate in the long grass and hid there when they heard me coming."

"Sheridan had a different experience. Opened the big gardening cupboard on the verandah and was eyeballed by a **Cunningham skink** lounging on the top shelf."

Margaret added "At a nature reserve the other day, we lifted up an old piece of masonite that had been lying around for an eternity, and there were **three Little Whip Snakes** underneath it. This doesn't compete with your three different species, but is an interesting observation however."

The Australian & International Scene

The Ellerton Drive Extension that promises to free up Queanbeyan's roads but is splitting the community and putting pressure on Tim Overall

*By Megan Doherty & James Hall,
The Canberra Times, 12 January 2017*

It's meant to be an \$86 million road to ease traffic congestion in rapidly growing Queanbeyan but it is turning into a political problem for the city's administrator and a source of contention for locals who say the bypass is being built only to pander to developers.

The federal Department of the Environment and Energy on Tuesday approved with conditions the controversial Ellerton Drive Extension, the final green light needed for the 4.6km road which will bypass the central business district on the eastern side of Queanbeyan, running through bushland and crossing the Queanbeyan River.

A three-person panel led by Queanbeyan-Palerang Regional Council administrator Tim Overall approved the road locally but Mr Overall, alone, gave the go-ahead for the council to contribute \$36 million to the project.

The federal and state governments are also each providing \$25 million. Tenders for the road are yet to be called.

Greens politicians have called for the road to be stopped until a business case is presented, concerned about environmental damage and transparency of the process.

Tree-clearing along the route started on Thursday with protesters soon on the scene, saying the road should not have been considered for approval until a new council was elected in September this year, with 11 councillors due to be voted in.

"We don't have a council anymore. It's just a one-man band," local resident Wayne Brewer said.

The clearing of trees and termite mounds in the first instance has to be restricted to January, after which the resident Rosenberg's monitor lizards start to lay their eggs in the mounds.

Among the conditions attached by the federal environment department was a limit on the amount of native bushland and plants to be cleared.



Above: Trees start to be cleared for the Ellerton Drive Extension in Queanbeyan, photo supplied.

The extension runs from the end of Ellerton Drive, near Yass Road/Bungendore Road, in Queanbeyan East to the Old Cooma Road/Edwin Land Parkway intersection in Karabar.

Eden-Monaro federal MP Dr Mike Kelly is among those who have been campaigning against the road, which is expected to pass right past his house.

Dr Kelly said he had always been upfront about his personal interest in the road but was also concerned about potential damage to a "delicate river corridor" and the manner in which the link was approved.

He said the State Government should have appointed a caretaker not an "unelected political contestant" in charge of the council until the elections were held.

"I don't think there is any doubt this is a controversial project and needs to be subject to a democratic process," he said.

Those concerns were echoed by former councillor and Queanbeyan-Palerang Regional Council mayoral candidate, Brian Brown. "At this stage we should be in caretaker mode, not going gangbusters to destroy the bush land before the community can have a say on whether or not that's the option they want to choose," Mr Brown said.

Mr Overall is on leave and unavailable for comment but Queanbeyan-Palerang general manager Peter Tegart said the road had been subject to other resolutions of the previous Queanbeyan City Council which approved studies and concepts for the route.

While the road design had not been approved before the forced merger, the administrator had the capacity to consider any project that was ongoing.

"There's complete legal legitimacy around that decision," Mr Tegart said.

The corridor for the Ellerton Drive Extension had been identified on council maps, plans and strategies since the 1970s and supported to some degree by eight previous councils, it says.

Critics of the project including Queanbeyan Conservation Alliance spokesman Graham Franklin-Browne doubt the road will divert traffic out of the heart of the city, particularly trucks.

"They say it's been on the map for 30 years but just because a decision is 30-years-old doesn't make it a good decision," Mr Franklin-Browne said.

Protesters including Frank Briggs maintain the road is being built as a link to the proposed Jumping Creek 300-lot housing development on the eastern side of the Queanbeyan River, south of Greenleigh.

"If they want a better Queanbeyan, they should be concentrating on high-density housing in the city to bring it to life," Mr Briggs said.

Mr Franklin-Browne said the Jumping Creek development would harm a unique escarpment between the coast and the inland.

Mr Tegart confirmed the Jumping Creek development relied on the EDE being built.

However, he said the housing development was not approved and would need to be put through a whole new planning process.

He said the council had a wider road network plan that also included the upgrade of intersections and the EDE was not the sole answer to traffic congestion for the city.

How snakes lost a blueprint for making limbs

Sciencedaily, materials provided by Cell Press, 20 October 2016

Snakes lost their limbs over 100 million years ago, but scientists have struggled to identify the genetic changes involved. A *Cell* paper sheds some light on the process, describing a stretch

of DNA involved in limb formation that is mutated in snakes. When researchers inserted the snake DNA into mice, the animals developed truncated limbs, suggesting that a critical stretch of DNA lost its ability to support limb growth during snake evolution.

"This is one of many components of the DNA instructions needed for making limbs in humans and, essentially, all other legged vertebrates. In snakes, it's broken," says Axel Visel, a geneticist at the Lawrence Berkeley National Laboratory and senior author on the paper. "It's probably one of several evolutionary steps that occurred in snakes, which, unlike most mammals and reptiles, can no longer form limbs."

Today's serpents have undergone one of the most dramatic body plan changes in the evolution of vertebrates. To study the molecular roots of this adaptation, Visel and his colleagues started looking at published snake genomes, including the genomes from basal snakes such as boa and python, which have vestigial legs -- tiny leg bones buried in their muscles -- and advanced snakes, such as viper and cobra, which have lost all limb structures. Within these genomes, they focused specifically on a gene called Sonic hedgehog, or Shh, involved in many developmental processes -- including limb formation. The researchers delved further into one of the Shh gene regulators, a stretch of DNA called ZRS (the Zone of Polarizing Activity Regulatory Sequence) that was present but had diverged in snakes.

To determine the consequences of these mutations, the researchers used CRISPR, a genome-editing method, to insert the ZRS from various other vertebrates into mice, replacing the mouse regulator. With the ZRS of other mammals, such as humans, the mice developed normal limbs. Even when they inserted the ZRS from fish, whose fins are structurally very different from limbs, the mice developed normal limbs. However, when the researchers replaced the mouse ZRS with the python or cobra version, the mice went on to develop severely truncated forelimbs and hindlimbs.

"Using these new genomic tools, we can begin to explore how different evolutionary versions of the same enhancer affect limb development

(The Australian & International Scene, cont'd,...)

and actually see what happens," says Visel. "We used to be mostly staring at sequences and speculating about molecular evolution, but now, we can really take these studies to the next level."

To identify the mutations in the snakes' ZRS that were responsible for its inactivation during snake evolution, the researchers took a closer look at the evolutionary history of individual sequence changes. By comparing the genomes of snakes and other vertebrates, they identified one particularly suspicious 17 base-pair deletion that only occurred in snakes; this deletion removed a stretch of the ZRS that has a key role in regulating the *Shh* gene in legged animals.

The research team turned back the evolutionary clock, restoring the missing 17 base pairs in an artificially created hybrid version of the python ZRS, and tested the edited DNA in mice. Those that carried this evolutionarily "resurrected" ZRS in their genome, replacing their normal regulator, developed normal legs.

However, Visel cautions that the evolutionary events were probably more complex than just the one deletion: "There's likely some

redundancy built into in the mouse ZRS. A few of the other mutations in the snake ZRS probably also played a role in its loss of function during evolution."

Of course, snakes aren't the only vertebrate animals that lack arms and legs -- some lizards, eels and other fish, and marine mammals, for example, have also adapted limb reduction to varying degrees and likely underwent a slightly different evolutionary process. "Loss of limbs has occurred multiple times independently during animal evolution, and it's safe to assume that mutations affecting other genes were involved," says Visel. "It's a complex problem, but with the introduction of genome-editing tools, we can finally start tying specific DNA changes to alterations in body shape more systematically."



ACTHA News
PO Box 160
Jamison ACT 2614