Keeping Bugs Alive, alive

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This year Melbourne Museum celebrated its 14th birthday at the Carlton site and 11th year of operating the Bugs Alive Gallery. Bugs Alive is a chance for visitors to experience the amazing world of live spiders and insects first hand.

The gallery comprises over 50 live animal displays, videos, pinned specimens and graphics, presenting themes such as venom, camouflage, warning colours, social structures and diversity.

Bugs Alive presents an exciting work environment for the animal keeper; it's an ever-changing gallery with daily maintenance, enclosure changeovers, off-display husbandry and breeding trials, and the opportunity to be involved in education programs, tours, workshops, and display design. With over 15 field trips a year there is no better place to work in Australia.

The Live Exhibits Team was established in 2001 when the Museum moved to our new premise in Carlton, Victoria. The department currently consists of 18 staff members including Horticulture and Animal Keeping staff.

Live Exhibits is involved in almost every aspect of the museums operation including displays, off-display animal keeping, public programs and presentations, education programs, outreach programs, customer service training, PR, back of house tours, media, field trips, workshops for schools and professionals and much more.

Live Exhibits manage a large animal collection, comprising of 171 species of animal, including birds, frogs, fish, reptiles, mammals and invertebrates. The collection is mainly made up of invertebrates with 128 different species of invertebrate in our care.

We are responsible for many different displays in the museum including the Forest Gallery, Discovery Centre, Marine Gallery, 600 Million Years, Sci Pod, Milarri Garden and Bugs Alive.

- The Forest Gallery is 1,485 square metres (16,000 square feet) of living tall temperate rainforest rising over 35 meters (115 feet) in the centre of the museum, comprising of 117 species of plants and 30 species of animals. The space interprets the Toolangi Ranges to the north of Melbourne, giving visitors a chance to see bushland and wildlife they might otherwise not witness.

- The Discovery Centre is an interactive centre where Murray the Murray Darling Carpet Python (*Morelia spilota metcalfei*) adds a touch of excitement to the learning and exploring space. He gives the visitor a hint of what might be inside the museum, where live animals are still unexpected in Australia.
- The Marine Gallery's Rocky Reef display, is an underwater insight into the extensive life of the often thought to be barren Port Phillip Bay, which is surrounded by Melbourne.
- 600 Million Years, is a gallery that explores the evolution of Victoria over the past 600 million years, it includes living fossils with our Australian Lungfish (*Neoceratodus forsteri*) display.
- Sci Pod is an education nook with Stick Insects; these are used during education programs with school groups.
- Milarri Garden is a beautiful Indigenous garden with 147 plant species, the majority of which were used by the First Peoples. Milarri Garden is home to five fish species, Macquarie turtles and a number of wild birds including a breeding pair of Tawny Frogmouths (*Podargus strigoides*)
- The Museum also has four other gardens the North Terrace, Wild Garden, Children's Garden and the Discovery Centre Garden, which are expertly maintained by our Horticulture team.

Entrance to the Bugs Alive gallery
Image: Chloe Miller
Source: Museum Victoria


Forest Gallery boardwalk
Source: Museum Victoria

One of Live Exhibits main responsibilities is the management of the Bugs Alive gallery.

Bugs Alive gives our visitors the opportunity to get up close and personal with 50 live animal displays, comprising of over 100 species of invertebrate. Bugs Alive is not merely a display of animals, it conveys important themes and messages through the use of live animal displays, videos, graphics, pinned and preserved specimens, audio, text and scale models. Our team has carefully constructed a collection plan in conjunction with the themes presented in the gallery. The themes are broad so displays can be changed over and kept fresh for frequent visitors. The exhibition is message driven so everything must have a purpose and contribute to the messages being presented. The gallery receives around

3,286 visitors a day with a satisfaction rating of 95%. Live Exhibits staff spend an average of two hours servicing the gallery each day, plus the extra work put in to changing and updating displays.

Some of the main themes in Bugs Alive include:

- Diversity: where we use cockroaches and katydids to show the diversity of insects in Australia. Showing a variety of species in the one enclosure allows the visitor to see the simple differences between animals, from behaviours to coloration and markings. Using beautiful animals also help breakdown many of the stereotypes people have about insects.
- Habitats: here we use mini habitat displays to show some of the different habitats invertebrates live in – Aquatic, Grassland, Arid, Rainforest, Alpine. This gives visitors the opportunity to compare the different habitats and the different physical adaptions insects may have developed to live in different environments.
- Predators and Avoiding Predation: there are three displays dedicated to predators, we generally shy away from spiders and opt for less obvious predators or ones with cool hunting techniques, like tiger beetles, katydids and mantis. We also have a mixed species display that houses two species of insect, one that uses camouflage and one that uses warning colours to avoid predation. We often use Gumleaf Grasshoppers (*Goniaea australasiae*) and Blistered Pyrgomorphs (*Monistria pustulifera*) in this display.
- Ecosystems: one of our favourite displays is this Black House Ant (*Iridomyrmex glaber*) colony; the animals navigate through a maze to reach two food chambers. We also feed our Thorny Devils (*Moloch horridus*) on this ant colony during opening hours. The graphics explain the ecosystem of the grasshopper eating the grass, the ant eating the grasshopper and the Thorny Devil eating the ant, the circle of life.
- Australian Quarantine and Introduced Pests: Australia has very strict rules around biosecurity. Only a handful of exotic animals can be kept in the pet trade, mainly birds. This display shows the risk to Australian wildlife from illegally importing exotic wildlife. We also have two displays showing 'aliens' that are now wide spread in Australia the Australian Cockroach (*Periplaneta australasiae*) and the Garden Snail (*helix aspersa*).
- Venom and Poison: these displays showcase some of Australia's most feared invertebrates the Funnel-web Spider (Family Hexathelidae), the Red-back Spider (*Latrodectus hasseltii*) and the Jumping Jack (*Myrmecia pilosula*). The associated text breaks down the differences between venom and poison, it also explains the history and development of antivenin.
- Household Neighbours: These displays show a few different species of spiders that might be found in local houses. An up-close look at the spiders and the related text aims to breakdown some of the fears and myths that surround these lovely locals.

- Bugs that Help and Hinder the Museum: this display shows how insects can be both helpful and harmful in a museum. One display holds a colony of Hide beetles (*Dermestes maculatus*) hard at work, de-fleshing the skeleton of a rat, getting it ready for the Science Collection. We also show the damage insects can do to collections through the use of a taxidermy Tree Kangaroo that's fur has been eaten by moths.

Predator display wall in Bugs Alive
Image: Chloe Miller
Source: Museum Victoria

Habitat displays in Bugs Alive
Image: Chloe Miller
Source: Museum Victoria

Bugs Alive has be designed to direct visitors in a circular motion through the gallery, with a logical transition between themes. The gallery is also designed to give warning to visitors of upcoming 'scary' sections, such as the tarantula zone, through the use of pinned specimens and graphics. The spider skin wall is a clear indicator that if you have arachnophobia now is a good time to turn around.

For the Bugs Alive gallery to be sustainable it is necessary to have off-display facilities for breeding animals, housing back species and husbandry trials for new species of animals.

To support the Bugs Alive gallery Live Exhibits has four off-display breeding rooms. The rooms are broken up into environment type. Temperate (Local), Humid (Far North Queensland), Hot and Dry (Mallee/Alice Springs) and Aquatic (Fresh and Salt Water). Each room is climate controlled through heaters, water sources to create humidity and fans.

The Temperate Room is maintained at 22°C (71°F) with a 12 hour light cycle and basking lights on some enclosures. In this room we house a number of species including ants, stick insects, funnel-web spiders (in wine chillers at 17 °C (63°F)), and snails.

The Humid Room is maintained at 27 °C (81°F), 80% humidity with a 12 hour light cycle and basking lights on some enclosures for 3 hours. Housed in this room are tropical species of katydids, grasshoppers, scorpions and centipedes, juvenile stick insects, leaf insects, tarantulas, mantis and some species of spiders.

The Dry Room is maintained at 25 °C (77°F) during the day and 22 °C (71°F) overnight. The room is on a 12-hour light cycle with basking lights of 2 or 12 hours on enclosures. Housed in this room are huntsmen, wolf spiders, dermestid beetles and arid species of grasshoppers, katydids, scorpions, centipedes and mantis.

The Aquatic Room contains freshwater tanks at 22 °C (71 °F) housing water scorpions, needle bugs, backswimmers and leeches. While the salt tank at 16 °C (61°F) house crabs, sea stars, chitons and abalone.

Humid room enclosures
Image: Chloe Miller
Source: Museum Victoria

Dry room enclosures
Image: Chloe Miller
Source: Museum Victoria

While we breed a lot of our animals in-house and trade amongst other Zoos we also supplement our collection with a variety of wild caught animals. Field trips are a lot of fun and a fantastic opportunity for our staff to get out and learn more about our animals in their natural habitat. They also give us opportunity to find exciting animals that are new to captivity and our collection.

Live Exhibits conducts at least 15 different field trips on varying frequency, to different parts of Australia.

Local trips (within 2 hours drive of Melbourne) are conducted as they are needed. We collect Meat Ants (*Iridomyrmex purpureus*) by sucking them up with dust busters then transfer them back to work in oiled tubs. Bull Ants (*Myrmecia* sp) and Jumping Jacks (*Myrmecia pilosula)* we collect by gently digging up the burrow, and picking up the ants one by one with forceps. To collect Black House Ant (*Iridomyrmex glaber*) colonies we leave out old termite mounds near active ant trails and wait for them to move into the ready-made 'apartment blocks'. Collecting leeches is always a fun trip, it involves wading out in leech-infested waters, waiting for the leeches to attach to your waders and using a net to help catch them. Similarly with collecting water bugs we wade around with nets. To collect marine invertebrates we snorkel around local rocky reefs and use nets and hand collect animals. Local trips usually require two staff members and take between two hours to the full day.

Once a year during the wet season (December to February) a team of three will travel to Far North Queensland for seven days to collect tropical and arid animals. We collect from the botanical gardens, parks and reserves, roadsides and fruit farms. We do most of our collecting at night, working from sunset into the early hours of the morning. After four or five hours of sleep we a back at it again, looking after the animals and out searching for more. We collect via direct search, light traps, and driving slowly along quite roads. On our trips to tropical Queensland we collect katydids, huntsman, mantis, tarantulas, scorpions, centipedes and beetles. We also collect Green Tree Ants (*Oecophylla smaragdina*) nests from time to time. Collecting tree ants can be an entertaining but painful process. Once we've located a good nest someone gets the job of climbing up the tree and cutting down the nest while a second person gets the unfortunate job of standing under the nest and trying to catch it in a bucket. Both people usually end up covered in angry ants, resulting in a lot of squealing. While the trips are a lot of hard work they are also very rewarding.

Invertebrates collected from Cape Tribulation, Far North Queensland
Source: Museum Victoria

Live Exhibits staff search under tin, on the fruit farm, Cape tribulation, Far North Queensland
Source: Museum Victoria

On our 2013 trip we were luck enough to find a male Gargantuan Stick Insect (*Ctenomorpha gargantua*) one of the world largest stick insects. Despite its large size Gargantua is extremely hard to find in the wild, as it lives high up in the rainforest canopy. While the odd male flies into a light trap, only a handful of specimens can be found in entomological collections. In 2014 while searching along the sides of Copperlode Dam road, after a tropical cyclone our luck got even better. We found an old female Gargantua that was blown down to a lower canopy in the storm. While the female died shortly after her collection, it gave us hope that more were out there and it was possible to find them. Copperlode Dam road is a steep winding road that is cut into the hillside. The step edges allow us to collect from the canopy of the trees growing further down the hillside.

Twice a year during summer (November to March) we head to the Mallee in North West Victoria to collect arid species of cockroaches, huntsmen, wolf spiders, katydids, grasshoppers, centipedes, scorpions, mantis and beetles. A usual trip is between two and four nights with three staff members. We find the most successful method for collecting in

the Mallee is driving along hot roads at night; we also collect via direct search and triangulation, racking spinifex and light trapping.

Every few years we take a trip to Alice Springs in Central Australia in the wet season (December to February) this trip is weather depended and requires big hot rains to be productive. We use direct searching, light trapping and night driving just outside of Alice Springs to collect arid species of grasshoppers, mantis, katydids and centipedes.

In late summer (February to March) we head to Alpine Victoria to collect Alpine Katydids (*Tinzeda albosignata*), Mountain Katydids (*Acripeza reticulate*), Thermos Colour Grasshoppers (*Kosciuscola tristis*) and Alpine Funnel-webs (*Hadronyche alpina).* A lot of these animals are used for a seasonal winter display at the museum, while the funnel-webs are used in one of our venom displays.

We also take part in opportunistic collecting when out and about, and while participating in the Museum's Science department's trip such as BioScans.

Once we've collected new animals its essential we give them everything we can to make them a success. We do this by trying to replicate their natural habitat and comparing them to past and current animals in the collection we've had success with. We do food trials for herbivores, by offering the food plant the animal was found on and a range of alternative plants to see if any others, easier to supply plants are eaten. We've found beans are a widely eaten, easy to supply food plant. We will also supply Orthopteran mix and fruit. We've found that some tropical animals actually do better in a drier environment when in captivity, such as the Tiger Huntsman (*Typostola* sp).

Mitchell's Cockroach, *Polyzosteria mitchelli*
Source: Museum Victoria

Tiger Huntsman, *Typostola* sp
Source: Museum Victoria

Once we have the animal thriving the next step working out egg laying, incubation and nymph husbandry. While this is often straight forward with a lot of animals, others like the Mitchell's Cockroach (*Polyzosteria mitchelli*) can require a little more work. We currently have a healthy population of Mitchell's Cockroach, they feed well, mate and lay plenty of oothecae, however the management of their offspring has long been problematic. The offspring rarely live past third instar, and we've never had one make it to adulthood. We've

tried increasing and decreasing their exposure to UV light, different temperature ranges, extensive food trials, providing different moisture gradients and different substrate types and furniture with no change in success rate, but we are not giving up on this beautiful species. Through continued research, husbandry trials and husbandry mistakes we will eventual find the answer. Another fundamental step in successful husbandry is accurate and thorough record keeping, so what works and doesn't work is recorded for future use.

Live Exhibits encompasses so many different aspects of animal husbandry including collection planning, enclosure design, education programs and field trips. With animals in museums still being a relatively new concept in Australia working at the Melbourne Museum is an exciting and ever changing work place.