# FOCUS

THE AUSTRALIAN DOCTOR MAGAZINE

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FOCUS ON OLYMPICS

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# SHALLOW HELL

Our deadliest marine mystery

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# COME HELL ON HIGH WATER

AUSTRALIA CAN BOAST A DIVERSE RANGE OF POISONOUS NASTIES, BUT THE BOX JELLYFISH AND ITS MINIATURE COUSIN, THE IRUKANDJI, ARE AT THE TOP OF THE TREE. THANKFULLY, SCIENCE IS AT LAST CATCHING UP WITH THESE DEADLY MARINE MYSTERIES.

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Photography **PAUL SUTHERLAND**

Like most sensible divers working on the Great Barrier Reef, Chris Ingham has avoided the box jellyfish. He knows all about the agonising death that can occur from contact with the trailing tentacles of *Chironex fleckeri*. Just a year ago a seven-year-old boy died after a chironex sting – the 68th known fatality. But by confining his summer diving to the outer reefs, Ingham felt safe: he knows chironex stay close to the mainland's shallows.

He'd certainly never been bothered about its miniature cousin, the irukandji. Ingham knew these little blighters packed a sting, but assumed the couple of tourists who died after allegedly being stung by them were "just old men – weaker than myself".

Ingham discovered the error in his thinking in May. Diving for sea cucumbers, he had barely entered the water when he felt "thousands of stings" all over his body. The pain dissipated, but shortly afterwards he was surprised to find himself swimming into what felt like a strong current. Making no headway against it, he decided to turn around to swim with it – but, strangely, the current seemed just as powerful the other way. Only then did he realise something sinister was happening.

"It felt like a boa constrictor was wrapping itself around my chest, getting tighter and tighter," he recalls. He struggled back to the boat just as he was hit by intense pains in his back, stomach and limbs. Once on deck, he began vomiting profusely. Then his legs collapsed from under him. Believing he had the bends, he grabbed an oxygen mask and inhaled for 30 minutes, but the symptoms only became worse.

"Mate, you must have been stung by an irukandji," suggested his concerned crewman, Phil Fox. With their home port, Cairns, an eight-hour boat ride away, Ingham wanted to head back immediately. But they were stuck in a dangerous maze of coral reefs. Ingham was convinced Fox didn't have the experience to pilot his way through,

so, convulsed with pain and vomiting in gushes, Ingham asked Fox to physically lift him to the wheel so he could steer them clear.

As Ingham lapsed in and out of consciousness, Fox radioed for urgent medical help. A rescue helicopter arrived 25 minutes later and Ingham was airlifted to Cairns Base Hospital.

"I wouldn't wish that pain on my worst enemy," he says ruefully. "It's sharp. *Incredible*. All my muscles were spasming – my legs and arms were thrashing about. My skin and even my deep muscles felt as if they were being attacked by needles. It's a pain that goes right through your body. I honestly thought I was going to die."

But after a night in intensive care, he insisted on being discharged the following day.

The culprit? Any one of a variety of irukandji jellyfish, precise species unknown. Ingham believes the transparent creature must have been diced by his boat's propeller. When he entered the water, he had dived into a soup of venomous stinging cells.

Behind a door marked 'Danger', in a laboratory full of bubbling tanks at James Cook University in Townsville, Heather Walling proudly shows off her 'babies'. Kitted out in latex gloves and overalls, Walling retrieves a dish from a saltwater tank that seems to contain grains of white pepper. These are polyps of *Carukia barnesi*, the best-known form of irukandji, suckered to the dish. Under a microscope, the polyps are revealed as glassy, anemone-like creatures each waving nine tentacles.

"Look at the stinging cells on the end of the tentacles," says Walling, a masters student in aquaculture. "They're huge, like stingers on steroids. Nobody knows exactly how toxic they are."

These babies are special. This April, Walling and Lisa-Ann Gershwin, a doctoral student and taxonomist, became the first scientists to breed *C barnesi* in captivity. The polyps are the offspring of around 200 adult jellyfish collected off Palm Cove in Cairns and Magnetic Island, near Townsville. Soon, each of the polyps will metamorphose into a medusa, an adult jellyfish. The breeding program will enable toxicologists to determine the mechanisms of the venom, improve treatment regimens — and perhaps even manufacture an irukandji antivenom.

"I was incredibly paranoid when I first started working with these jellyfish," Walling says. She practically wrapped herself in latex when she had to individually feed the 200 adult irukandji in the lab.

Each year between 70 and 250 people are stung by irukandji jellyfish off the coast of northern Australia. "Almost all will be hospitalised," says Dr Peter Fenner, marine stinger officer at Surf Lifesaving Queensland and an associate professor at the School of Medicine at James Cook University. "Some will die."

The deaths of two tourists in 2002 have been attributed to irukandji, yet the species responsible couldn't be determined. "Irukandji syndrome is a bit like dog-bite syndrome," Fenner says. "You can say it's a dog, but it might be a bulldog or a poodle or a mastiff."

It was Fenner, co-founder of the International Consortium of Jellyfish Stings and a GP practising in Mackay, Queensland, who first described an irukandji fatality for the *Medical Journal of Australia*, recording how Richard Jordan, a 58-year-old Briton, had a fatal brain haemorrhage shortly after telling his wife he had been stung by 'something' off Hamilton Island in 2002. Disturbingly, Fenner says neither of the two deaths were caused by *C barnesi*. The stinging cells extracted from the chest of one of the victims came from an unknown species.

But scientists are rapidly closing in on these mysterious stingers. Gershwin, who is rumoured to "eat, sleep and breathe jellyfish", has caught and identified nine new species capable of causing irukandji syndrome. Six of these were captured in the past two years, including a highly toxic species that plagues pearl divers off Broome.

Her quest forms part of ground-breaking research into the biology of box jellyfish at James Cook University, the CRC Reef Research Centre and the Australian Institute of Marine Science. The different species of box jellyfish, all members of the cubozoan family, range from the minute irukandji to the melon-sized *C fleckeri*, the world's most venomous marine animal.

It is only when you see a live box jellyfish that you realise how difficult it is to avoid them in the water. Walling points out several specimens of a new species of box jellyfish of the genus *chiropsalmus* that she has been rearing. Inside a tank marked "Kramer Jnr, Caught Feb 4 Cairns", I first spot pale tentacles trailing through the water. Then I see the diaphanous bell, gently pulsating, towing the poison lines behind it. The body is as clear as glass, marked only by the wiggly, white flower shape of its digestive glands. Tentacles hang in clusters from four corners of the bell.

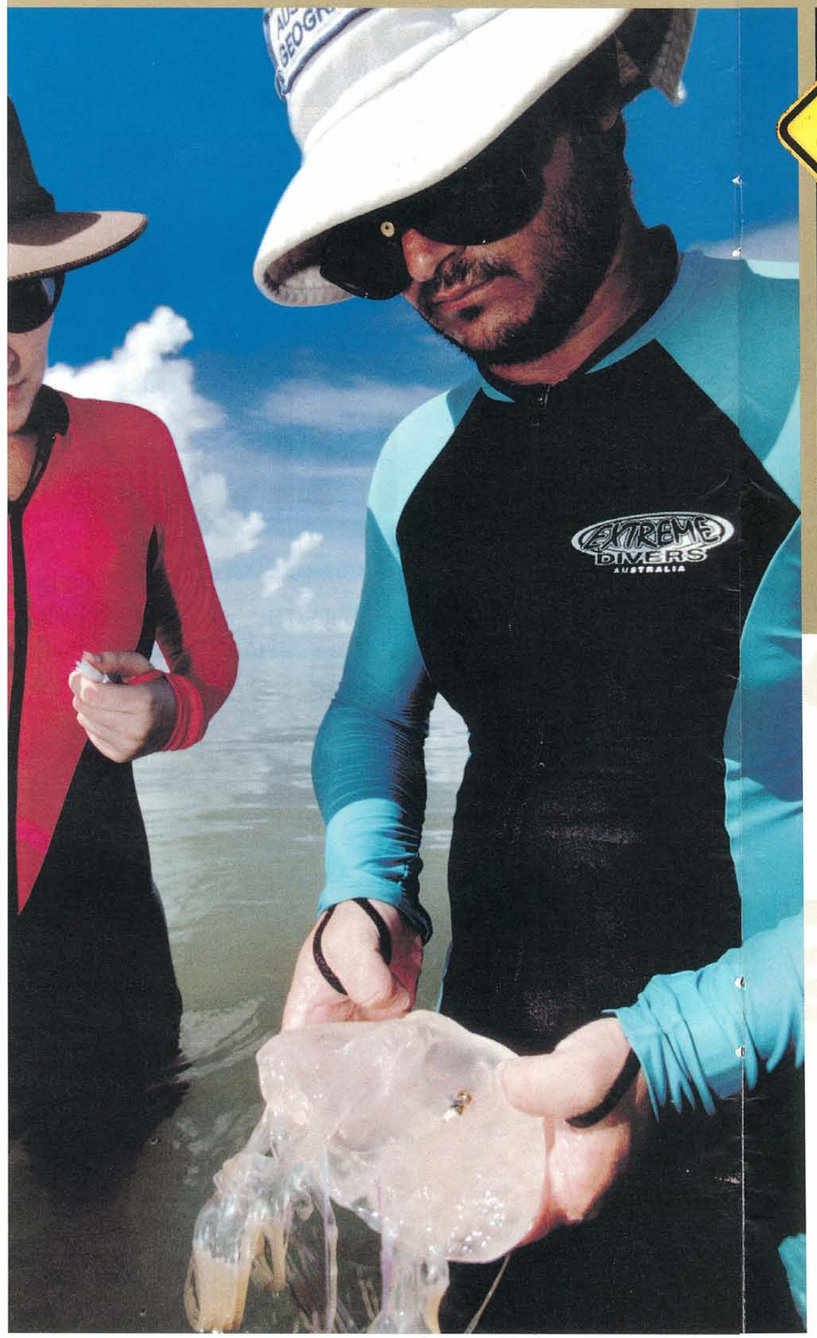
Walling feeds the jellyfish a sliver of shrimp with a pair of yellow tongs. As soon as the shrimp touches the tentacles, they sting and retract, drawing the morsel into the creature's mouth. The food is then engulfed by the bell, like a specimen caught in clear perspex, and then slowly absorbed by the flower-like stomach.

While Kramer's species is related to chironex, and its stings cause great pain, it is unlikely to be lethal to humans.

"But you wouldn't want to touch it," Walling says. "If you feel it through gloves you find the tentacles are sticky. The upper body is like a rubber bouncy ball. It's the strangest feeling."

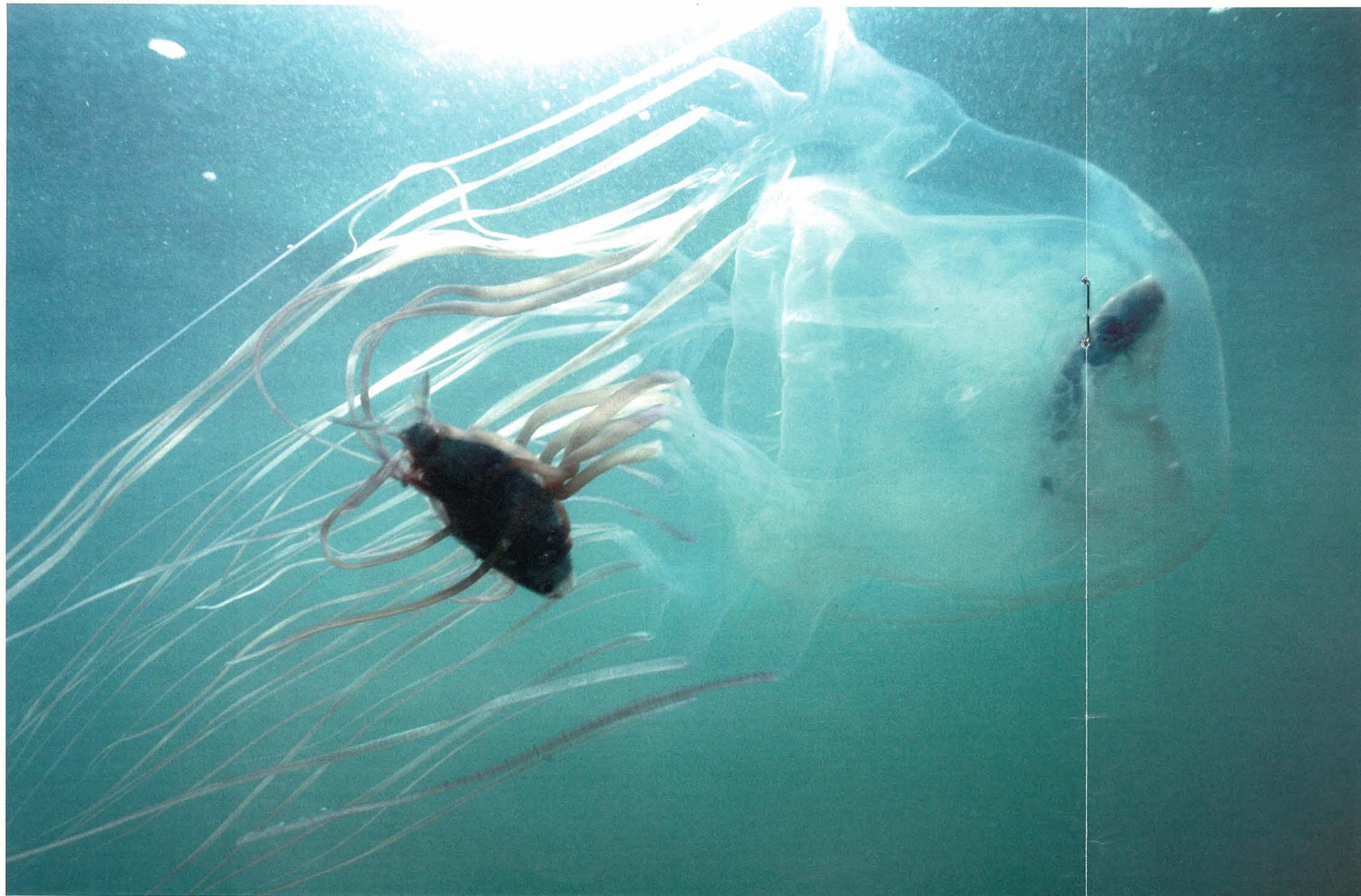
When biologist Jamie Seymour appeared on a recent episode of ABC TV's *Catalyst*, he came across as an oceanic version of Steve Irwin, plucking giant chironex bare-handed from the water. Dubbed the 'jellyfish man', Seymour directs the Tropical Australian Stinger Research Unit (TASRU) and lectures in the School of Tropical Biology at James Cook University's Cairns campus. At TASRU, he and biologist Teresa Carrette are working with emergency doctors and toxicologists to find out more about the life cycles of jellyfish, the nature of their venoms and how best to treat patients.

TASRU takes the approach 'know thy enemy'. To that end, Seymour has been tagging and tracking chironex with the assistance of a *National Geographic* grant. While he can't yet divulge his findings, it's clear he admires his subjects.




PaulSutherlandPhoto/www.sutherlandimages.com; Linda Vergnani; Newspix


Left to right: Researcher Jamie Seymour takes a box jellyfish (and his life) into his own hands as he attaches a tracking device; Seymour's research has seen signs like these outdated, with the stinger danger period now understood to extend until the end of June; The tiny irukandji, which slips easily through the protective stinger mesh to inflict its torture on between 70 and 250 swimmers a year.



The box jellyfish uses its stingers to trap and stun a baitfish while it digests another inside its bell. Contact with one of those stingers results in an agonising few minutes – before you die.

"If a standard jellyfish is a mini moke, the box jellyfish is a Formula One," he says enthusiastically. "These are active visual predators. We've seen them corral up fish like killer whales, and then one breaks through into the middle and grabs the fish."

Seymour says that if he could teach box jellyfish to do tumble-turns, they'd come within five minutes of matching Grant Hackett over 1500 metres. "These guys are so impressive," he says. "They are without doubt the most venomous marine creatures on the planet. They can cause death in two to three minutes in a human."

A fully grown chironex has 60 tentacles, each of which extends up to three to four metres. The venom extracted from a single specimen could kill 60 people. Yet Seymour stresses that box jellyfish don't intentionally harm humans: "If you stand in the water and don't move, they swim around you."

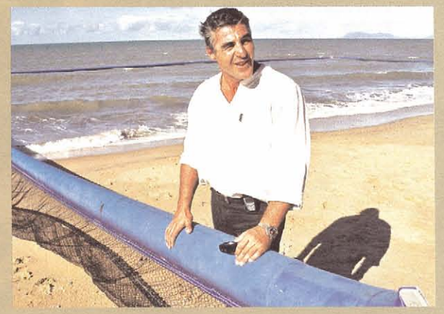
Research by Teresa Carrette has shown that not all chironex are deadly. Before they fully mature, box jellyfish prey on shrimps and other invertebrates and have a milder toxin. It's only when they reach about 10cm in size and start hunting fish that they develop a completely different neurotoxin specifically targeted at vertebrates and potentially lethal to humans.

"THESE ARE ACTIVE VISUAL PREDATORS. WE'VE SEEN THEM CORRAL UP FISH LIKE KILLER WHALES." – JAMIE SEYMOUR

Seymour insists he isn't being reckless handling these creatures barehanded. He wears a suit of neoprene and titanium, but gloves might injure the specimen, and he feels safe, provided he handles only the bell without touching the stings. "It's like handling a snake," he says. "You've just got to know which end to pick up."

Yet he *has* been accidentally stung by both chironex and *C barnesi*. Showing me the ladder tracks of chironex stings on his hands, Seymour says this jellyfish causes a "surreal pain".

PaulSutherlandPhoto/www.sutherlandimages.com; Linda Vergnani x2



Heather Walling (left) with one of her 'babies', the first irukandji bred in captivity; and professional diver Chris Ingham, who has learned his lesson – ignore irukandji at your peril. "I wouldn't wish that pain on my worst enemy."

"It's just like a red-hot knife dragging across your skin – then intensify that pain 10 times and hang on to it for 20 minutes. You're sitting there saying, 'Jesus, this is really bad.' Then suddenly it's gone."

The venom goes directly into the arterial system, and depending on the dose can kill in minutes. In contrast, the irukandji jellyfish sting is mild at first, but kicks in after 10-30 minutes and causes days of agony. Seymour believes this venom is circulated through the lymphatic system.

Late last year, while filming the tiny creatures, Seymour was stung on the lip by an irukandji jellyfish. Although he was wearing his stinger suit, booties, mask and snorkel, he got "nailed" on the only part of his face that was exposed.

"Boy, was I sick. I was in hospital for 18 hours," he says. "I had wracking pain right through my body. I tend to suffer from severe lower-joint pain in my knees, ankles and feet. I spent all night with my finger on the PCA syringe. At times I am sure if someone had given me a gun, I would've ended it."

But Seymour's work is paying dividends. Already he has developed a computer program that accurately predicts the start and end of the chironex season, based on rainfall patterns. Chironex polyps metamorphose into medusae with the start of the summer rains; the jellyfish grow rapidly in size and patrol the shallows until the dry season when, surprisingly, they die off.

Although stinger nets used to be put up on the beaches between October and May, Seymour found that the chironex season ends anytime between February and the end of June. The Cairns council now uses his program to determine when to lift its protective nets.

Seymour is also compiling an atlas of the stinging cells of different kinds of box jellyfish. Most jellyfish have 3-4 types of stinging cells that are species specific; so far he has recorded 19 out of 28 species. When Cairns Base Hospital admits a patient who has been stung, Seymour is called to take a skin scraping to identify the culprit. Those stings are like a fingerprint – though the index is incomplete.

Dr Peter Pereira, director of emergency medicine at Cairns Base Hospital and a member of TASRU, notes: "In 2001/02 out of 116 people who came in [to Cairns Hospital], we got a positive identification from 43 patients of *Carukia barnesi*."

Ironically, about half the irukandji victims were stung while bathing *inside* the stinger net enclosure at the resort of Palm Cove. The nets may stop the *chironex* but the mesh is too large to prevent the irukandji slipping through. Pereira, who treated Chris Ingham, says: "If people wore stinger suits it would cut out 75 per cent of stings."

"There's so much work to be done on irukandji syndrome – it's just fascinating," says Dr Michael Corkeron, an intensive care specialist at Townsville Hospital. Corkeron recently reported that magnesium sulphate had been effective in relieving the high blood pressure and pain of irukandji syndrome in one particular case, offering some hope to future patients, but now he says that subsequent results have been mixed. "It seems to help some people but not others. We have a lot to learn about that dichotomy in response."

A diver, Corkeron first became interested in jellyfish envenomation as an intern when one of his colleagues was stung by an irukandji in the Whitsundays and became very unwell. He says treating irukandji patients isn't contingent on one particular drug or strategy. "I actually have little hope that even development of an antivenom would make a difference to outcomes, because what people need to have, if they are sick with it, is rapid access to a high level of care."

He says the way to avoid more deaths is to make sure that people who get very high blood pressure due to irukandji syndrome are treated quickly. But Corkeron believes the focus needs to be on prevention; last summer saw a drop in irukandji cases at Townsville Hospital because local lifesavers closed beaches on days when these creatures were found in the water or when someone was stung.

Diver Chris Ingham now knows the advantage of prevention. When we meet at Trinity Beach near Cairns, 10 days after his traumatic encounter, he looks in rude health, but says: "I'm still getting these weird sensations. Every now and then it feels as if someone is stabbing me with a knitting needle."

For nine years he dived for sea cucumbers wearing only a vest and football shorts. Now he has resigned his diving job. And as he says: "If I get back in the water, I'll be wearing a full-length wetsuit and hood."