Queensland scientist closes in on world breakthrough to beat killer disease

This could be the end of dengue

EXCLUSIVE

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A QUEENSLAND scientist is on the brink of eliminating the deadly global disease threat of dengue fever after more than 15 years of painstaking research.

The University of Queensland's Professor Scott O'Neill will start his world-first field trials to wipe out the mosquito-borne disease in far north Queensland this week.

The project, funded by the Bill & Melinda Gates Foundation's Global Health Program, hopes to control dengue by introducing a bacteria to mosquitoes that stops them passing on the virus to humans.

The bacteria, known as Wolbachia, has a powerful ability to invade natural populations of insects and alter their reproduction and lifespan.

"I was always interested in science but I wanted to do science with a practical outcome," Prof O'Neill, 48, said.

"This is very exciting for me and my team – we can provide a real solution to the global burden of disease."

Dengue is a significant disease that has no effective controls or vaccine – it affects billions worldwide and costs millions of dollars to treat.

It is carried by an urban-dwelling mosquito that, once established in cities, is almost impossible to eradicate.

Dengue hot spot Brazil spends US$800 million a year on pesticides to control mosquitoes and still has one of the highest cases of infections in the world.

"The scary thing is dengue is getting worse, with a broadening geographic distribution and outbreaks becoming more severe," Prof O'Neill said.

"We can see that in our own experience in Australia."

There were more than 1000 cases of dengue in Queensland in 2009 – the worst outbreak in 50 years.

But discovering the effect Wolbachia has on the dengue-carrying Aedes aegypti mosquito did not happen in a "lightbulb moment" – it has taken decades.

"When you are doing scientific work more experiments fail than succeed, so you keep chipping away to find ways around the problem," Prof O'Neill said.

"I think it's a sickness that a lot of scientists have – they are very obsessive people and that's what makes them so tenacious about their projects."

One member of the Eliminate Dengue team was once required to manually inject 10,000 mosquito embryos with the bacteria to test their survival.

Prof O'Neill was first alerted to Wolbachia by former UQ professor Hugh Patterson when he was Patterson's student in the 1980s.

Scientists had been thinking about the bacteria as a way of controlling insect populations but Prof O'Neill wanted to test its ability to prevent disease transmission.

Leaving Brisbane for the US, he kept up his investigations as a junior professor at Yale University for 10 years.

Returning to UQ as head of the School of Biological Sciences, his team was the first to apply molecular biology to the bacteria sequencing the Wolbachia genome.

"Dengue is spread by old mosquitoes (12 days old)," he said.
THREAT: Professor Scott O’Neill says dengue fever is on the rise.

“I thought if we could shorten their lifespan we could stop transmission of the disease.

“It not only shortened their lifespan but it interfered with the virus’s ability to grow in the insect.

“That was quite an amazing discovery and it means this approach can be much more effective.”

This week Prof O’Neill’s team will begin releasing Wolbachia-infected mosquitoes into the wild population.

The CSIRO has done a nine-month risk analysis on releasing Wolbachia mosquitoes into the general population to breed.

Prof O’Neill said this type of science was heavily regulated in Australia and they were being extremely careful because they did not want to create another biological problem like the cane toad.

“The cane toad was a foreign organism introduced into a new environment but Wolbachia already occurs naturally in up to 60 per cent of the insect population,” he said.

In September the Australia Pesticides and Veterinary Medicines Authority gave the project approval to proceed to field trials at Yorkeys Knob and Gordonvale near Cairns.

Over the past 15 years, the international collaboration has involved more than 14 institutions and 50 scientists from Australia, Vietnam, Thailand, the US and Brazil.
THE DENGUE MENACE

- 2.5 billion people are at risk of the disease globally
- 100 million cases confirmed each year
- Reactions to the virus range from mild to severe and in some cases death from haemorrhagic fever
- There are four types of the dengue virus
- Once infected with one dengue virus type, if re-infected with another type, it is life-threatening
- Treatment in a developing country like Vietnam would cost a farmer one-third of his annual income
- Dengue is carried by the aedes aegypti mosquito found in rural and urban environments, not in swamps, creeks or lagoons
- The mosquito lays its eggs in buckets, tyres, pot plant bases and roof gutters
- To transmit disease the mosquito must be an adult (about 12 to 14 days old)
- Plane travel spreads dengue as people carrying the virus arrive in places with aedes aegypti mosquitoes