Centipede venom could lead to new class of pain drug

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The venom of the Chinese red headed centipede may be an effective in treating pain. Credit: Thomas Brown

A protein found in centipede venom could be developed into a drug to treat chronic pain that is as effective as morphine but without the side effects, researchers say.

The joint Australian-Chinese study, published today in the journal *PNAS*, found that a small protein in the Chinese red-headed centipede proved as potent as morphine to relieve pain in mice-based experiments.

The protein, called a peptide, alters the function of the nerve channels, selectively targeting the Nav1.7 pain channel. And because it has a different target to morphine, it could be used to treat all types of chronic pain.

"Venomous arthropod predators, like centipedes, scorpions, and spiders, worked out a couple of hundred million years ago that the best way to kill an insect is to target their nervous system," explained study co-author Glenn King, from the University of Queensland's Institute for Molecular Bioscience. "So that's why decided to study centipede venom."

Of the six venom-based drugs currently approved for human use, only one – derived from the venom of a marine cone snail – is used to treat pain. However, it targets an ion channel in the central nervous system. "So you actually have to have a small implantable device that delivers the peptide into your spinal cord," Professor King Said.

The newly discovered peptide, in contrast, has a peripheral target, so it could be given intravenously, subcutaneously, or perhaps orally, because it does not have to get into the brain or spinal cord to take effect.

Better pain relief

One in five Australians suffer from chronic pain. It is notoriously difficult to treat, partly because of the side effects and addictive qualities of the available pain relievers.

Even over-the-counter drugs such as ibuprofen, aspirin and codeine have side effects when taken at high dose and for long periods of time, Professor King said, but opioid-based drugs such as morphine are problematic because users become tolerant.

"As you start to take them, it down-regulates the opioid receptor, which

means we need to take more of the drug to have the same effects. So we take more and more," he said. "The drug itself can be addictive, so it ends up causing addiction and abuse."

Clinical senior lecturer at Deakin University and pain specialist at Barwon Health Michael Vagg said the study was an exciting development.

"A drug which was a selective Nav1.7 blocker would be possibly a 'perfect painkiller', in that it selectively and effectively prevents the generation of pain signals from tissue, while not affecting any other nerve functions," he said.

"There are individuals who are born with non-functional Nav1.7 channels and these people have a complete inability to feel pain, and no other significant problems apart from loss of smell sensation.

"Forget about using opioids to relieve pain, this drug could mean you don't have any pain to relieve. It would be totally new class of drug."

Research translation

The next step for the research team is to test the peptide in more sophisticated rodent pain models that better resemble human pain conditions such as osteoarthritis, cancer pain and neuropathic pain.

"We've tested the molecule in very simple models of pain in mice and the question is always how predictive that will be – and how well it will work – in humans," Professor King said.

If the next phase of animal studies is successful and it appears safe for human use, Professor King hopes it would be ready for clinical trials within two years.

More information: Discovery of a selective NaV1.7 inhibitor from centipede venom with analgesic efficacy exceeding morphine in rodent pain models, www.pnas.org/cgi/doi/10.1073/pnas.1306285110

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