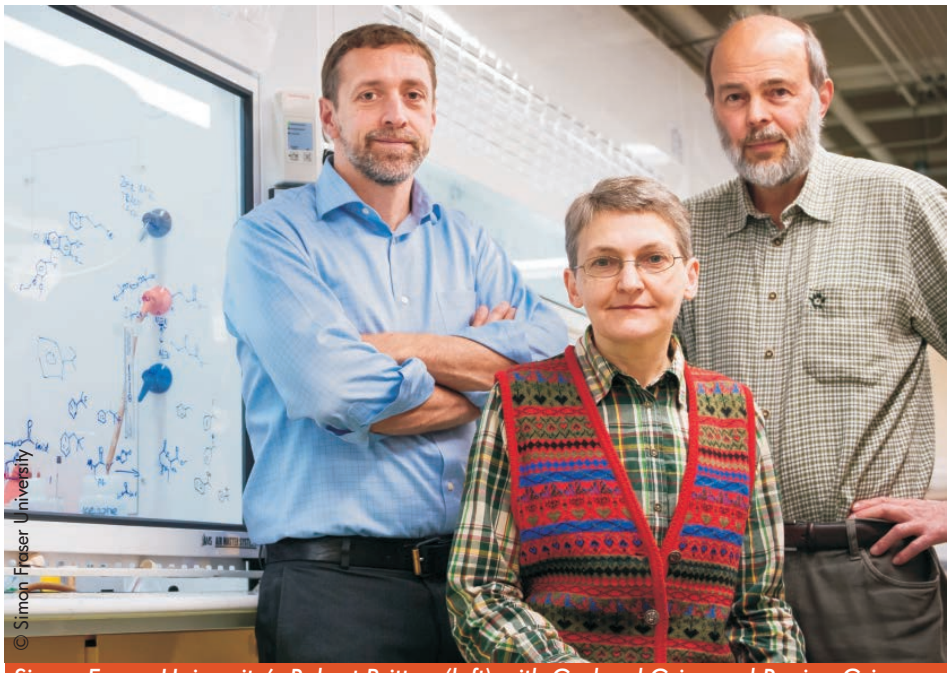
Bed bug breakthrough?

Five years of research has led a team from Canada's Simon Fraser University to identify the secret of which chemicals cause bed bugs to aggregate and, just as importantly, what chemical signals to them that this is a 'safe shelter'. Could this be the breakthrough in monitoring that the industry has been waiting for?



Simon Fraser University's Robert Britton (left) with Gerhard Gries and Regine Gries. Five years of research has led them to identify the bed bug aggregation pheromone

After a series of successful trials in the laboratory and, significantly, in bed bug infested apartments in Vancouver, a team of researchers from Simon Fraser University in British Columbia, Canada has published its research: *Bed bug aggregation pheromone finally identified* in the scientific journal *Angewandte Chemie*.

The team comprises biologists Regine Gries, her husband Professor Gerhard Gries, chemist Robert Britton and a team of Simon Fraser students.

The paper details how the team made its discovery, which the researchers say represents new and affordable technology – just 10 cents (around 5p) per lure – to allow successful bed bug detection and even control. Indeed, the team is now working with a Canadian company to commercialise the technoloy and expects it will be available within the next six to nine months.

So, what is it that has been discovered?

Earlier work by the same team, had identified three volatile components in the pheromone that causes bed bugs to come together (aggregation). These attracted bed bugs in laboratory experiments, but not in bed bug infested apartments.

"We realised that a highly unusual component must be missing—one that we couldn't find using our regular gas chromatographic and mass spectrometric tools," explains Gerhard Gries.

The biologists therefore teamed-up with chemist Robert Britton, an expert in isolating and solving the structure of natural products, and then synthesising them in the lab. He used the university's state-of-the-art NMR spectrometers to study the infinitesimal

amounts of chemicals that had been isolated from shed bed bug skin, looking for the chemical clues as to why the bed bugs find the presence of skin so appealing in a shelter.

After two years of frustrating false leads, the team finally discovered that histamine is the molecule that signals 'safe shelter' to bed bugs. Once in contact with the histamine, the bed bugs stay put, whether or not they have recently fed on a human host.

Yet, to everyone's disbelief, neither histamine alone nor in combination with the previously identified pheromone components effectively attracted and trapped bed bugs in infested apartments. Something was still missing. Work then began on analysing airborne volatile compounds from bed bug faeces as an alternate source of the missing components.

"We contend that our bed bug detection technology will be effective and affordable, and we are positive that the technology will be adopted by pest control professionals," says Professor Gerhard Gries.

Five months and 35 experiments later, Regine Gries had found three new volatiles that had never before been reported for bed bugs. These three components, together with two from the earlier research and histamine performed well in small laboratory experiments. The work was repeated in larger bioassay arenas that better reflect the more spacious nature of bed bug habitat.

Some corrugated cardboard shelters were baited with just the histamine, some with just the five volatile pheromone components (VPCs) and some with both histamine and VPCs. The shelters with both invariably attracted all the bed bugs in the arena. The conclusion was that highly mobile bed bugs are attracted to VPCs, but only adopt a shelter when histamine is present.

To determine whether this synthetic pheromone lure with histamine was effective in infested premises where competing attractants are present, the trapping experiments were repeated in a heavily infested apartment. Large captures of bed bugs were only achieved where the complete synthetic pheromone was used.

The general media were fascinated that Regine Gries was prepared to offer up her arms as food to 1,000 bed bugs per arm, every week, for five years

During the course of the experiment, the researchers report that they found all five nyphmal instars (fed and non-fed) as well as adult males and females (fed and non-fed), just like the natural aggregation pheromone.

Synthetic pheromone baited shelter traps were also effective in apartments with light to moderate bed bug infestations, claim the team. In all apartments where at least one live bed bug was found during careful inspection, at least one bed bug was captured.

Interestingly, because traps with the histamine component actually retain the bed bugs that have entered, there is no need for any sticky surfaces. Indeed the use of sticky traps actually prevented the bed bugs from coming into contact with the arrestant histamine component.

Our thanks go to Simon Fraser University News and the research team for providing access to their material. The team has a short video about the work at http://youtu.be/H5eXbf064P4

Can the research be turned into a practical tool?

Commercialisation may not be as easy as the researchers think, although they have won the backing of an industry partner, Contech Enterprises Inc based in Victoria, British Columbia. The company describes itself as 'a worldwide leader in designing, manufacturing and marketing products for the pet, garden and pest control sectors. It's a privately owned company and claims over 20 years of continuous growth.

UK bed bug expert **Clive Boase** from The Pest Management Consultancy welcomes the findings:

"Professor Gries' team has been working on this topic for some years and has already published several important papers on the components of the bed bug aggregation pheromone.

"In this latest paper, they believe they have finally cracked the complete composition of the pheromone. If correct, this is undoubtedly a **very significant breakthrough**.

"The trick now will be to combine these different compounds, each with very different physical properties, into a commercial product that releases the compounds in the right proportions and at the right concentrations. We will be watching progress closely…"

Australia's internationally renowned bed bug expert **Stephen Doggett** from Westmead Hospital is more sceptical:

"How many times have I heard someone come out with a claim of the next great thing for bed bugs and the item invariably fails. In the US there have been some landmark legal cases such that landlords, hotels/motels, etc have to demonstrate due diligence when it comes to bed bug monitoring. Traps are a potential way of doing this. Thus traps are going to sell, whether they work or not.

"Every trap we have tested to date (not a big number I have to admit) does not work. The issue is that there are so many competing harbourages in a room and many of these will contain aggregation pheromones due to the fact that bed bugs have been sitting there.

"Thus, even if there are traps with the perfect pheromone, I suspect they will not work all that well, simply because of the shear number of competing pheromones already in the room.

"In such circumstances to get traps to work well as monitors, you need lots, making it expensive and time consuming to inspect; thus commercially not viable. Thus I am highly sceptical, but I will wait and see."