Microscopic nanobees 'sting cancer tumours to death'

Microscopic "nanobees" that literally sting tumours to death have been successfully used to fight cancer by researchers in America. Published: 10:00PM BST 10 Aug 2009

The US scientists unleashed swarms of the tiny artificial particles on human breast and skin tumours in mice. Each spherical "nanobee", measuring just three millionths of an inch across, was armed with a cancer-killing toxin found in bee venom. Targeting cancer but not healthy cells, the nanobees delivered a lethal "sting".The bee toxin, melittin, destroys cells by drilling holes through them.

After four to five injections of melittin-carrying nanobees over several days, the growth of breast cancer tumours in the mice was slowed by nearly 25 per cent. Melanoma - or skin cancer - tumours shrank in size by 88 per cent. Professor Samuel Wickline, from the Siteman Center of Cancer Nanotechnology Excellence at Washington University School of Medicine, said: "The nanobees fly in, land on the surface of cells and deposit their cargo of melittin which rapidly merges with the target cells. "We've shown that the bee toxin gets taken into the cells where it pokes holes in their internal structures." The nanobees are made of perfluorocarbon, an inert material used in artificial blood.

Dr Wickline's team has been investigating their use in various medical applications, including the diagnosis and treatment of narrowed arteries and cancer.The nanoparticles are large enough to carry thousands of active compounds, yet small enough to pass easily through the bloodstream and attach to cell membranes. Melittin injected directly into the bloodstream would cause widespread destruction of red blood cells. But attached to the nanobees, blood cells and other tissues are protected from the toxin's effects. None of the mice suffered "collateral damage" from the treatment and had normal blood cell counts and no signs of organ damage.

Once injected, the nanobees congregated in the cancers because solid tumours often have leaky blood vessels and tend to retain material. The same property explains how certain drugs attack cancers much more than normal tissue.In addition, the scientists loaded the nanobees with special components designed to steer them to the right target. One targeting agent was attracted to growing blood vessels which proliferate around tumours. When this was added to the nanobees, they were guided to areas of precancerous skin damage where the blood supply was rapidly increasing. As a result, the spread of precancerous skin cells was cut by 80 per cent. Dr Paul Schlesinger, co-author, said: "Melittin has been of interest to researchers because in high enough concentration it can destroy any cell it comes into contact with, making it an effective antibacterial and antifungal agent and potentially an anticancer agent. "Cancer cells can adapt and develop resistance to many anticancer agents that alter gene function or target a cell's DNA, but it's hard for cells to find a way around the mechanism that melittin uses to kill. "Nanobees are an effective way to package the useful, but potentially deadly, melittin, sequestering it so that it neither harms normal cells nor gets degraded before it reaches its target." Reporting their results in the *Journal of Clinical Investigation*, the scientists said nanobees had the potential not only of tackling established tumours, but also halting the development of early-stage cancer. Prof Wickline said melittin was "easily and cheaply produced". "We are now using a non-toxic part of the melittin molecule to hook other drugs, targeting agents or imaging compounds on to nanoparticles," he added.Attaching imaging agents to the spheres could provide a visual indication of how much medication gets into tumours and what effect it has. The flexibility of the nanoparticles meant they could readily be adapted to fit medical situations as they arise, said the scientists. "Potentially, these could be formulated for a particular patient," said Dr Schlesinger. "We are learning more and more about tumour biology, and that knowledge could soon allow us to create nanoparticles targeted for specific tumours using the nanobee approach."