

'DNA CLAMP' TECHNOLOGY TO HELP CANCER TREATMENT

UNDERSTANDING AT MOLECULAR LEVEL

MONTREAL: An international team of researchers has developed tiny technology that can spot genetic mutations at the DNA level before diseases such as cancer develop. Scientists are calling this nanotechnology a "DNA clamp" and say it could revolutionize screening and treatment of cancer, and other diseases with a genetic basis.

"The clamp is made from DNA and it's made to bind with DNA. It's as small as it can get," said Alexis Vallée-Bélisle, a professor in the chemistry department at the Université de Montréal, and one of the developers behind the discovery.

Researchers believe that this innovative technology could one day help speed disease diagnosis and help tailor treatment. The next step in the research is to try the clamp in clinical settings using human DNA samples.

A big challenge in cancer therapy now is understanding cancer at molecular level, Vallée-Bélisle said.

"The mutation is affecting which protein, and that protein is responsible for what regulatory function in the cell? We might have the specific drug for that protein, but if you don't know which mutation, you cannot efficiently treat the cancer.

"That's why we need to have these rapid diagnostic tests."

Published this month in the journal ACS Nano, researchers found that the DNA clamp performed more precisely and quickly than current genetic testing for mutations, developed in the '90s and called "molecular beacons."

Tiny material

Like a clothing peg on a laundry line, DNA is the perfect tiny material for creating scaffolds or clamps that can hold other molecules in place, Vallée-Bélisle said. The DNA clamp was designed to become fluorescent if it detects mutations that signal a high risk for cancer.

The nanotechnology field has exploded recently with researchers designing many nanostructures using DNA codes, Vallée-Bélisle added.

One challenge is to improve cancer therapy where toxic drugs destroy both healthy and malignant cells to eradicate disease.

Research teams are currently designing DNA nanomachines able to carry and deliver drug therapies to targeted tumour cells while sparing the rest. "For us it was really exciting to devel-

op this clamp," Vallée-Bélisle said. "It's a specific tool that may have a lot of applications." Many advances in diagnostic tests in the past years have built upon the discovery of the DNA double helix by James Watson, Francis Crick and Rosalind Franklin in the '50s.

The clamp designed by Vallée-Bélisle, and researchers Andrea Idili and Francesco Ricci of the University of Rome Tor Vergata, and Kevin W. Plaxco, University of California Santa Barbara, is, in essence, a triple helix.

It turns out that when two strands clamp onto a third DNA sequence, it provides an even more sensitive way to identify a mutation, Vallée-Bélisle said.

An increasing number of genetic mutations have been identified as risk factors for the development of cancer and many other diseases. Single gene defects, according to researchers at the University of California, San Diego School of Medicine, may lead to diverse neurological disorders like Alzheimer's, Parkinson's and Huntington's diseases.

Many people have tapped into their personal genetic makeup with the advent of popular companies like 23andMe that sprung into existence since scientists first sequenced the human genome more than a decade ago. "People are sequencing and sequencing and we're getting more and more information about what a single mutation will do to an organism," Vallée-Bélisle said. "As our samples get bigger, we are starting to see high correlations for specific cancers."

Genetic mutations

Women with a family history of breast cancer, for example, regularly seek tests for BRCA1 and BRCA2, the genetic mutations that greatly increase a lifetime risk of such cancer by 60 to 80 per cent in some families.

Actress Angelina Jolie had a preventive double mastectomy last year after learning she carried the gene that made it extremely likely she would get breast cancer. The research was funded by the Italian Ministry of Universities and Research (MIUR), the Natural Sciences and Engineering Research Council of Canada, the Bill & Melinda Gates Foundation Grand Challenges Explorations program, the European Commission Marie Curie Actions program, and the US National Institutes of Health. — The Gazette



MEMPHIS: Certified industrial hygienist Gary Siebenschuh putting on a hazardous materials suit before entering a home that once served as a clandestine methamphetamine lab in Memphis. The house was placed under quarantine after a Nov 6 fire that police said was caused by a meth lab that exploded in the attic of the house. —AP photos



MEMPHIS: Certified industrial hygienist Gary Siebenschuh, center, and his assistant Courtney Van Stolk, left, speaking with homeowner Dick Cochran after searching for methamphetamine residue in the house he rents in Memphis.

CLEANING UP HOMES WITH METH LABS GROWING INDUSTRY

MEMPHIS: A tall man and a slender woman wiggled into their white hazardous materials suits, putting on protective masks and gloves before venturing into the dark, two-story home where police say a methamphetamine lab recently exploded. Gary Siebenschuh and a helper used a yellow photo ionization detector to measure for meth residue, maneuvering around debris and a hole in the roof caused by the Nov. 6 fire that injured a young child. They took wipe samples of walls, ducts, window sills and other parts of the home, later sending them to a lab to be analyzed.

"The process is extremely cumbersome but I think it's necessary," said Dick Cochran, owner of the Memphis home where a renter was charged with making meth and causing the fire and explosion. He hired Siebenschuh to inspect the property. "You don't know how bad a house can be contaminated," Cochran said.

Cottage industry

Tens of thousands of houses have

been used as meth labs the last decade and a cottage industry is developing around cleaning them up. Many Americans are more aware of the production of the highly addictive drug thanks to AMC's hit show "Breaking Bad," which featured a high school chemistry teacher who turned into a meth cooker and dealer. In real life, cleanup contractors are the ones who deal with a property when a batch explodes or police raid an operation and shut it down.

However, there is little oversight of the growing industry in most states, opening the door for potential malfeasance. And some homeowners are often reluctant to pay thousands of dollars to make a property safe, so many houses simply don't get cleaned for years, exposing residents and sometimes even neighbors to harmful chemicals. Cochran expects to spend thousands to make the house rentable once again, with much of the cost covered by his insurance company. However, that is not the norm; Many insurance policies do not cover meth cleanup.

To make a meth home safe, a certi-

fied contractor must remove and replace all contaminated materials, from walls to carpet to air conditioning vents. Next, a certified "industrial hygienist" tests the home to gauge whether it can be lived in or needs more cleaning.

Hygienists and contractors find homes in different states of disrepair. Homes with no fires or explosions are easier to clean, but there is often a pungent odor, contaminated cooktops, carpets and walls, leaky roofs and dirty furniture. In the case of Cochran's home, Siebenschuh had to maneuver around scattered debris and a burned-out shell of a second floor and attic. "You do testing in the front end, so we can find out how much meth is there," said Siebenschuh, whose company, G7 Environmental Services, also does testing for asbestos, mold and other contaminants. "Then the homeowner hires a contractor, and then he cleans it up."

Contaminated homes

Despite laws requiring landlords to disclose if meth had been made on a property, experts say such disclosures

often don't happen and there are many people living in contaminated homes nationwide.

Exposure to meth residue can cause respiratory problems, and health officials say meth homes pose a threat to public safety. For example, squatters may enter abandoned homes, and children play around them.

Over the last decade, tens of thousands of homes have been used to cook meth, according to federal data. About 25 states have laws related to meth cleanup. Some states, such as Indiana, Kentucky and Tennessee, place meth homes on quarantine lists. Some properties on Tennessee's list date to 2006, underscoring the years it often takes for some properties to be cleaned. Cleanup costs can range from \$3,000 to \$25,000, depending on the home's size and the amount of contamination.

Joe Mazzuca, CEO of operations for Meth Lab Cleanup LLC, said his business has been growing 30 percent annually in recent years. "We consider it to be still in its infancy," said Mazzuca, a leader in the meth cleanup industry.—AP

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