Scientists identify spontaneously chain-reacting molecule

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In the burgeoning field of nano-science there are now many ways of 'writing' molecular-scale messages on a surface, one molecule at a time. The trouble is that writing a molecule at a time takes a very long time.

"It is much better if the molecules can be persuaded to gather together and imprint an entire pattern simultaneously, by themselves. One such pattern is an indefinitely long line, which can then provide the basis for the ultimately thin molecular 'wire' required for nano-circuitry," says John Polanyi of the University of Toronto's Department of Chemistry, co- author of the paper to be published on Nature Chemistry this week.

The paper describes, for the first time, a simple molecule that each time it chemically reacts with a surface prepares a hospitable neighbouring site at which the next incoming molecule reacts. Accordingly, these molecules, when simply dosed (blindly) on the surface, spontaneously grow durable 'molecular-chains'. These molecular chains are the desired prototypes of nano-wires.

The experiments were conducted by graduate student Tingbin Lim in the John Polanyi Scanning Tunneling Microscopy laboratory at U of T, in conjunction with theory performed by postdoctoral fellow Dr. Wei Ji in the Hong Guo laboratory in the Department of Physics, McGill University. The experiments in Toronto yielded visual evidence of the chains, and the theory at McGill explained why the chains spontaneously grew.

"Early-on, far-sighted Xerox Research Centre Canada (XRCC) recognized this opportunity for imprinting patterns at the molecular scale, thereby persuading Ontario Centres of Excellence (OCE) and the federal Natural Sciences and Engineering Research Council (NSERC), through its Strategic Grant program, to fund the bulk of the research costs in our lab," says Polanyi.

"The experiments constituted the doctoral work of a recent PhD student in the Toronto laboratory, Dr. Tingbin Lim an outstanding student who came from Singapore to join our group and now makes his home as a scientist in Canada."

More information: The paper, entitled "Surface-mediated chain reaction through dissociative attachment" will be published on *Nature Chemistry's* website on December 12.

Provided by University of Toronto