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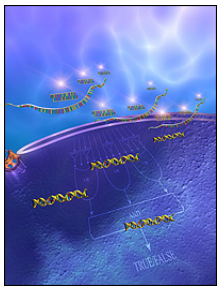
DNA Computers Cleansing Your Body's Cells

The first step: siRNAs turning off genes



A new DNA-based computing scheme uses short pieces of RNA [below pink markings] to deactivate genes introduced to human cells
KIRK MOLDOFF

A newly designed type of DNA computer for human cells could one day lead to the development of a technology able to eliminate the diseased cells and separate them from the healthy ones. The technology is based on the process of RNA interference (RNAi) in which small RNA molecules stop a gene from synthesizing its protein. In the long run, the main aim is to inject human cells with DNA that can assess if a cell is cancerous or diseased, just by measuring the molecules' complex inside the cell. When detecting a disease, the DNA could release a minute dose of treatment. At the moment, the team is investigating various methods of transforming DNA into versatile computers that can recognize certain molecule combinations and respond by synthesizing others. "The central challenge is how do you create a 'molecular computer' capable of making decisions. Researchers have designed powerful test tube DNA computers that could play tic-tac-toe or perform the basic tasks of logic, but getting them to work in human cells was likely to be tricky" said bioengineer Yaakov Benenson of Harvard University. RNAi are natural molecules involved in turning genes off. Benenson's team modeled a target gene to respond to various different siRNAs (small interfering RNAs). In the simplest case, a single siRNA molecule could turn off a target gene encoding for a fluorescent protein; but in more complex approaches, a pair of siRNAs or either of the two different siRNAs turned off another target gene, which then turned off the gene encoding the fluorescent protein. The siRNAs based tests were also made on other species, for a more relevant verification of the reliability of the method. "In principle, the RNAi technique can reach great heights of complexity, by making genes sensitive to more and more siRNAs in various combinations. The scalability is very important, because eventually you want to make complex decisions. The next step is figuring out how to make the molecules inside a cell-such as those that are overproduced in cancer-trigger the production of siRNAs", said Benenson.