Scientists to explore nano advancements in DNA sequencing

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UC Irvine's Henry Samueli School of Engineering has been awarded $2.18 million to blend traditional DNA sequencing techniques with cutting-edge nanotechnology to develop a faster and less costly method of analysis. The goal is to make DNA sequencing feasible as a routine part of health care.

If implemented, widespread DNA analysis could provide doctors with more resources to predict disease, prevent potential illness and better customize prescription medication to complement patients' specific health and treatment needs.

UC Irvine's three-year grant was awarded as part of a $15 million initiative by the National Human Genome Research Institute (NHGRI) to support the development of innovative technologies with the potential to drastically reduce the cost of DNA sequencing.

The institute, part of the National Institutes of Health (NIH), announced grants for eight researchers to develop genome sequencing technologies that could produce a total genetic composition of an individual for $1,000. UC Irvine received the second largest of these grants.

Three additional researchers were funded to work on nearer-term technologies that could sequence a genome for $100,000. Currently, it costs about $5 million to sequence DNA for humans and other mammals – by painstakingly analyzing the 3 billion base pairs that comprise the building blocks of DNA. The process can take months to complete.

"If we could make DNA sequencing and testing available for all patients during medical exams by taking a simple blood test, we could directly impact the future of health care and create opportunities to improve a patient's quality of life," said H. Kumar Wickramasinghe, professor of electrical engineering and computer science and the Henry Samueli endowed chair, who is leading this research at UC Irvine.

Wickramasinghe will work with Robert K. Moyzis, a professor in UC Irvine's Department of Biological Chemistry and human genomics coordinator for the Institute for Genomics and Bioinformatics, to integrate nanotechnology with a Nobel Prize-winning DNA sequencing method developed in 1975 by Frederick Sanger.

The process will employ a novel DNA separation method using the atomic force microscope (AFM), a Wickramasinghe invention. Researchers will then decode the DNA sequence with the help of light concentrated at a probe that is about 50 atoms wide at its tip.

It will take substantially less time to sort, analyze and then map DNA using this technique, since the procedure operates on a much smaller scale than the conventional Sanger method.

This new process has the capability to produce accurate results that are both 10,000 times faster and less expensive to obtain, since many of the expenses related to current methods of sequencing DNA are tied to the time it takes and the large amount of chemicals used.

"Applying nanotechnology techniques to fundamental DNA sequencing methods allows nano pioneers like Professor Wickramasinghe the platform to contribute new advances that will directly affect the well-being and health of society," said Nicolaos G. Alexopoulos, dean of The Henry Samueli School of Engineering. "The school is excited to participate in this effort that will help advance the medical field and aid health care professionals in proactively diagnosing and better treating their patients."

Source: University of California - Irvine