A $1000 genome could be reached by 2013

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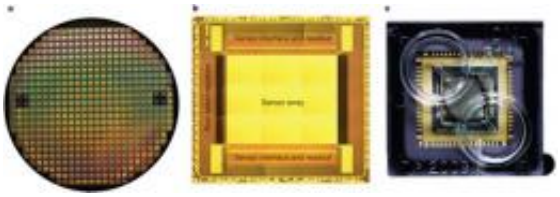

a, Fabricated CMOS 8″ wafer containing approximately 200 individual functional ion sensor die. b, Unpackaged die, after automated dicing of wafer, with functional regions indicated. c, Die in ceramic package wire bonded for electrical connection, shown with moulded fluidic lid to allow addition of sequencing reagents. Image (c) Nature, doi:10.1038/nature10242

(PhysOrg.com) -- A new report published in the journal *Nature* describes the new machine created by Jonathan Rothberg of Ion Torrent Systems which uses semiconductors to decode DNA and takes them one step closer to being able to reach the goal of a $1000 human genome test.

Their current machine consists of a silicon chip that has 1.2 million sensors consisting of miniature wells. These wells are filled with beads containing the DNA strands to be sequenced. Detectors in the well directly measure the hydrogen ions that are produced during DNA replication.

Gordon Moore, co-founder of Intel, was the first to have his genome sequenced with the new machine because Rothberg believes that he is responsible for giving the world modern semiconductors and should be

the first to be tested with them. It is also Moore and what is known as Moore's Law that makes Rothberg believe his technology will hit the $1000 genome mark by 2013. Moore's Law states that the number of transistors on computer chips doubles every two years.

The current machine costs around $49000 and is already on the market and being used in over 40 countries. Ion just released a new machine with a 10-fold improvement over its previous model and hopes to release a better machine within the next six months.

In addition to being able to sequence Moore's genome in a few hours, the machine was also recently used in China and Germany to sequence E. coli during the most recent outbreaks. In what used to take two to eight weeks to sequence, scientists were able to determine the E. coli in only three days and begin doing something about it.

The semiconductor chips that are used have a price tag of $99 each and to sequence Moore, for example, required 1000 chips. That price is already down from the original $250 chips. Rothberg is confident that by 2013 the technological advances will allow for even cheaper chips and that they will be able to sequence complete human genomes for only $1000.

More information: An integrated semiconductor device enabling non-optical genome sequencing, *Nature* 475, 348–352 (21 July 2011) doi:10.1038/nature10242

Abstract
The seminal importance of DNA sequencing to the life sciences, biotechnology and medicine has driven the search for more scalable and lower-cost solutions. Here we describe a DNA sequencing technology in which scalable, low-cost semiconductor manufacturing techniques are used to make an integrated circuit able to directly perform non-optical

DNA sequencing of genomes. Sequence data are obtained by directly sensing the ions produced by template-directed DNA polymerase synthesis using all-natural nucleotides on this massively parallel semiconductor-sensing device or ion chip. The ion chip contains ion-sensitive, field-effect transistor-based sensors in perfect register with 1.2 million wells, which provide confinement and allow parallel, simultaneous detection of independent sequencing reactions. Use of the most widely used technology for constructing integrated circuits, the complementary metal-oxide semiconductor (CMOS) process, allows for low-cost, large-scale production and scaling of the device to higher densities and larger array sizes. We show the performance of the system by sequencing three bacterial genomes, its robustness and scalability by producing ion chips with up to 10 times as many sensors and sequencing a human genome.