

Equipment manufacturers launch price cutting devices

Pocket Money Sequencing

While Roche and Applied Biosystems launch price cutting sequencing systems, former 454 protagonist Jonathan Rothberg is announcing his own solution.

Next-generation sequencing just got cheaper. Significantly cheaper. At the end of May, Roche Diagnostics launched its "GS Junior Benchtop System", advertised as, "a benchtop DNA sequencing platform for life science research, in a size that is no bigger than a typical desktop la-

ser printer" (well, a largeish printer, with dimensions of 40 x 60 x 40 centimetres). Small to medium sized laboratories are the favoured target group for the new apparatus, that will cost about €125,000 in basic configuration, being shipped with a desktop computer that is optimized for run process-

ing and downstream data analysis. The cost looks like pocket money, being just a quarter of the price of a conventional next-generation sequencer, such as Roche's GS FLX Titanium system and Applied Biosystems' SOLiD 4 System.

According to Roche, the GS Junior's main applications are the *de novo* sequencing of microbial genomes, targeted resequencing of amplicons (PCR products) and metagenomic characterization of complex environmental samples. Within 12 hours (for run and data processing), the device looks over 35 million ($3,5 \times 10^6$) bases, with a 99 percent accurate average read length of 400 bases (according to technical data).

In other words, a whole genome read of *E. coli* ($4,6 \times 10^6$ base pairs) would occupy Roche's Junior for less than a day. Reading human genomes ($3,2 \times 10^9$) would take significantly longer. However, this isn't the system's dedicated task, says Burkhard Ziebolz from Roche Diagnostics.

AB also dishes up a new whopper

It would, of course, be naive to believe that Roche's competitors haven't attempted to tinker together their own junior systems. Applied Biosystems, for example, is not only preparing for the €5,000 genome with its "improved" sequencing chemistry for the SOLiD 4 device, but is also to launch a slimmed-down sequencing machine for the smaller purse. The Californian company's "SOLiD PI" device will cost €185,000, be available in the second half of 2010, and the advertising information sheet overflows with promises like "cost-effective", "affordable" and "for every lab".

Well, just half the price of a SOLiD 4 chunk sounds good, but it's still quite a distance away from being really cheap, isn't it? With dimensions of 100 x 100 x 70 centimetres, it looks more like an oversized bever-

Jonathan Rothberg, a chemical engineer from New Haven, Connecticut, pioneered DNA sequencing with 454 Life Sciences in 2005 – and is to do it again with Ion Torrent's 'Personal Genome Machine' (PGM) sequencer.



age vending machine, compared to Roche's benchtop box. On the other hand, it generates up to 50 gigabases (50×10^9) of sequence data per day, according to the data sheet – significantly more than Roche's GS Junior system.

With only two runs, the SOLiD PI should thus deliver a human genome at a depth of 32-fold average coverage (even though Applied Biosystems recommends the SOLiD 4 systems for larger genome projects, while the PI apparatus is dedicated more to targeted resequencing and transcriptome analysis).

Price cutter from Connecticut

At almost the same time, Roche's competitor Ion Torrent (Guilford and San Francisco, USA) is blowing away any current cost hurdle with its newly developed €40,000 electronic sequencer. This price cutting device reads DNA on a semiconductor chip by measuring the release of hydrogen. Although it uses the usual polymerase-based sequencing-by-synthesis chemistry, the Ion Torrent system relies entirely on electronic detection while no longer requiring lasers, cameras and labelled nucleotides. According to the company, it can finish runs in one to two hours.

The sequencing show takes place on a 9 x 9 millimeter semiconductor chip. Unmodified nucleotides are sequentially added to the system and incorporated by DNA polymerase as usual. Each time a nucleotide is added, hydrogen ions are released which decrease the pH value of the surrounding solution. This change of pH is detected by an ion-sensitive layer underneath, then converted into voltage, and finally translated into sequence information. Every signal generated by the system is proportional to the number of repeat-

ed bases (similar to the 454 platform but, according to Rothberg, with significantly higher accuracy).

"The machine is a chip", Jonathan Rothberg, the company's co-founder and CEO, told GenomeWeb, "and our sequencer is the world's smallest solid-state pH meter".

Delicate issue

The Rothberg case is a delicate issue for Roche. Rothberg, now 47, is the inventor of massive parallel sequencing. Before the chemical engineer and biologist from New Haven, Connecticut, co-founded Ion Torrent in 2007, he initiated the formation of another pioneering sequencing start-up, 454 Life Sciences. In 2005, 454 released the first next-generation DNA sequencer. Two years later, Rothberg's 454 team,



(left) - While the first DNA sequencing machines were similar to the Xerox 9700 Electronic printing system, built in 1977 (above), Roche's brand new GS Junior sequencing unit is no larger than the antique operating unit on top (see blue arrow).

together with colleagues from the Baylor Genome Center (Houston), sequenced Nobel laureate James Watson's genome, being the first published sequence of an individual human. Rothberg also initiated the Neanderthal genome project together with Svante Pääbo from the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany.

However, in March 2007, 454 was purchased by Roche – while wine connoisseur

Freelance Biobusiness Writers Wanted

(Applications from the UK, France & Scandinavia especially welcome)

Please contact:
wk@lab-times.org

Rothberg founded Ion Torrent, becoming one of the Swiss group's most dangerous rivals again.

Sequencer grant programme for Europe

At least Roche still has some respite. The commercial release of Rothberg's price smashing "Personal Genome Machine" (PGM) won't be before the end of 2010. For the moment, Ion Torrent is looking for scientific collaborators who can suggest "killer applications" for the PGM system (in other words, applications that leverage it) by promoting scientific grant programmes.

For this purpose, two of the company's semiconductor sequencers, together with free assembly and bioinformatics software, will be awarded to scientists in Europe in the second half of 2010, Ion Torrent announced in June. By September 15th, researchers can apply under www.iontorrent.com/grant-program, by describing the experiment they would do with an Ion PGM sequencer.

For the future, Ion Torrent plans to sell, "tens of thousands of the PGM instruments". In doing so, they would snatch a good deal of the global DNA sequencing business, currently worth over €700 million and expecting growth of double-digit figures for the next several years.

WINFRIED KOEPELLE



(right) - Ion Torrent's forthcoming PGM sequencer measures the release of hydrogen ions and translates information about pH change into a DNA sequence.