

Illumina's Infinium HD BeadChip offers researchers the flexibility to screen 3,000 to 200,000 SNPs in focused genotyping studies for both human and non-human species.

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# You Need Arrays!

## Advances in biochip technology

Biochips (also known as microarrays, DNA chips and a host of other terms) are a driving force in the rapidly growing biotechnology industry. Name a biological process or organism and there is probably a biochip for it. There are chips to study programmed cell death as well as chips to help farmers breed better pigs and cows. Here are the latest microarray products and technologies that bring the twin benefits of higher throughput and speed to every corner of the biology universe.

Toxicity accounts for a large number of late-stage drug candidate failures. The **DataChip** (Data Analysis Toxicology Assay Chip) and **MetaChip** (Metabolizing Enzyme Toxicology Assay Chip) from **Solidus Biosciences** are high throughput, predictive screening assays designed to mimic how the human body will react when a drug is ingested. Used to measure the toxicity of compounds and their metabolites earlier in the drug development process, the biochips reduce the cost of developing new drugs and minimize the need for toxicity testing in animals. The DataChip is a 3D cell culture microarray in which any culturable cell line (including human liver, bladder, kidney, heart, skin or lung) can be used, allowing for organ-specific toxicity predictions. The MetaChip contains human liver enzymes and measures compounds' metabolism-induced toxicity. These chips can generate the data equivalent of approximately 10 microtiter plates, and many additional cell-based in vitro assays can be scaled down and run on the Solidus chip platform.

The study of genetics is another area seeing great advancements thanks to the development of biochips. **Illumina's Infinium® HD (High Density) iSelect Custom Genotyping** products offer researchers the flexibility to screen 3,000 to 200,000 SNPs in focused genotyping studies for both human and non-human species. By deploying the Infinium HD assay on the iSelect platform, customers have access to more than three times the number of SNPs per sample than on previously designed iSelect panels. The first commercially available high-density products include the OvineSNP50 and PorcineSNP60 BeadChips. These 12-sample SNP genotyping arrays enable researchers to economically and efficiently identify genetic variation in any breed of sheep or pig, allowing them

to make informed decisions on which animals to breed for increased productivity and disease resistance. AgResearch New Zealand scientist John McEwan, Ph.D., who was involved in the sequencing and SNP discovery component of the OvineSNP50 BeadChip development said, "We have produced a high-quality product that exceeds our expectations. Working with Illumina's FastTrack Genotyping Services, we've genotyped close to three thousand samples with the OvineSNP50 BeadChip and we plan to genotype at least the same number of samples every year hereafter." With the addition of these new chips, Illumina now offers five standard DNA Chips for agricultural research: BovineSNP50, EquineSNP50, CanineSNP20, PorcineSNP60, and OvineSNP50 BeadChips.

**Agilent's SurePrint G3 Microarrays** contain up to one million probes on a standard glass slide. Applications for the SurePrint G3 Microarrays are array comparative genomic hybridization (aCGH) and copy number variation (CNV). SurePrint G3 Microarrays offer researchers high-resolution aCGH/CNV data while providing lower cost per data point. These microarrays are available in four standard formats: a single million-feature array per slide (1x1M) and several multipack formats: 2x400K, 4x180K and 8x60K. Additionally, Agilent offers the Human CNV Association 2x105K Microarray for studying the association between CNV and disease. "This array design is enriched for approximately 11,000 previously identified CNV locations along the genome," said Chris Grimley, Agilent senior marketing director, Genomics. "The result is a highly validated, cost-effective CNV association tool, and we're very pleased to be making it commercially available to the wider research community."

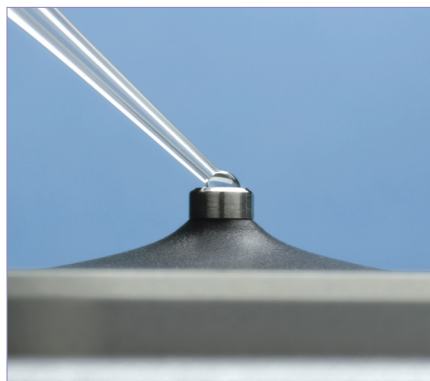
**Eppendorf Biochips Systems** offer a complete and integrated system from the microarray to data analysis. Products include the **DualChip<sup>®</sup> GMO** for food and feed investigation as well as the DualChip TF MAPK and DualChip TF Stem cell microarrays for transcription factor analysis. The **DualChip GMO Kit** identifies DNA from genetically modified organisms in food, feed and seed. The kit is a unique combination of 30 plant-species markers, constructs and event-specific targets in one test for the detection of multiple known and unknown GMOs. With 12 markers and data gathered from signaling pathways and kinases, the **DualChip TF MAPK** enables researchers to monitor cell proliferation as well as analyze the cellular mechanisms behind diseases. The DualChip TF Stem Cell monitors stem cell differentiation, proliferation or apoptosis by activated transcription factor profiling in samples of human, mouse or rat. The TF stem cell kit simultaneously monitors the activation of 12 transcription factors.

With the help of biochips, researchers are also gaining a better understanding of cancer cells, mutations and antibodies. The **RayBio<sup>®</sup> Human Apoptosis Antibody Array** can detect 43 different apoptotic proteins with picogram-per-milliliter (pg/ml) sensitivity. Researchers studying the deregulation of apoptosis in diseases such as coronary artery disease, HIV infection and cancer can use the array to increase detection of apoptotic proteins within their samples. The RayBio Human Apoptosis array kit is available for purchase immediately in both membrane and glass-slide array formats (AAH-APO-1 and AAH-APO-G1, respectively). The kit consists of the arrays and all reagents necessary for detecting these proteins in cell and tissue lysates. This array also features detection of GAPDH (Glyceraldehyde 3 phosphate dehydrogenase) as a loading control indicator for cell lysates tested with the array.

### Quality Control

While microarray technologies are invaluable tools, obtaining reliable, high quality data depends upon several factors. For instance, the quantity and integrity of starting materials can greatly affect the production of labeled antisense RNA (aRNA). Through linear amplification, **Enzo's BioArray<sup>®</sup> Single Round RNA Amplification and Labeling System** accommodates a wide range of input RNA (0.5 µg to 5 µg) with labeled aRNA yields significantly greater than those required for gene expression arrays. The all-in-one

system includes biotin-labeled nucleotides and is compatible with several microarray platforms. It offers highly sensitive eukaryotic mRNA analysis with minimal starting materials and increased percent calls on gene expression microarrays. Enzo also offers the CGH Labeling Kit for Oligonucleotide Arrays. By specifically optimizing labeling reagents, the kit produces high quality data with as little as 0.25 µg of genomic DNA and without the need for amplification.



A 1µl droplet is pipetted directly onto an optical pedestal.

Biochip probe preparation demands accurate quantitation and purity assessment, while minimizing the consumption of precious samples. The **NanoDrop<sup>™</sup> 2000c** spectrophotometer from **Thermo Fisher** uses a very small amount of sample for highly accurate quantitation without the need for cuvettes and capillaries. The user simply pipettes a 1µl sample directly onto a fiber optic measurement surface where it is held in place by a retention system. During each measurement cycle, the full absorbance spectrum of the sample is assessed at four different path lengths, resulting in the broadest dynamic range without the need for dilutions. The short path lengths allow researchers to measure samples up to 200-fold higher in concentration than can be measured on classical 1cm cuvette-based systems. Software modules designed for labeled samples display the full UV-Vis absorbance spectrum and calculate the concentrations of both the nucleic acid and fluorescent label. This enables researchers to determine incorporation rates with only 1 µl of final probe, preserving most of the sample for biochip hybridization. The NanoDrop<sup>™</sup> 2000c is unique in that the path can be diverted from the microsample retention system to a standard cuvette mechanism, giving scientists the choice to use the low-volume, extensive dynamic range of the pedestal measurement mechanism or traditional cuvettes.

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- John McEwan, Ph.D.  
*AgResearch scientist,  
New Zealand*

Companies mentioned in this Product Focus:

Affymetrix - [www.affymetrix.com](http://www.affymetrix.com)

Agilent - [www.agilent.com](http://www.agilent.com)

Enzo - [www.enzo.com](http://www.enzo.com)

Eppendorf - [www.eppendorf.com](http://www.eppendorf.com)

Genisphere - [www.genisphere.com](http://www.genisphere.com)

Illumina - [www.illumina.com](http://www.illumina.com)

RayBiotech - [www.raybiotech.com](http://www.raybiotech.com)

Solidus Biosciences - [www.solidusbiosciences.com](http://www.solidusbiosciences.com)

Thermo Fisher - [www.thermofisher.com](http://www.thermofisher.com)

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