

## Insights & Perspectives

# RatRef-12 Expression BeadChip

The newest member of the Illumina® Genome-Wide Expression BeadChip family

Derogatory phrases such as “you dirty rat” and “that ratty old sweater” demonstrate the disdain many humans feel for the furry, bewhiskered members of the genus *Rattus*. The rat’s role as transmitter of the Black Death and its penchant for sewers and garbage dumps have made the rodent a symbol of filth and pestilence. However, to scientists who use the rat as a model organism, the rat can be man’s best friend. For many studies, rats are preferable to mice due to their larger size, complexity, and superior intelligence. The rat is particularly well suited as a model in neurological, toxicological, pharmacological, and behavioral studies. In September 2006, Illumina’s introduction of the RatRef-12 Expression BeadChip was a boon to the large number of researchers who view the rat as a valuable model organism.

**“The rat remains the model of choice for the majority of brain anatomy projects.”**

Researchers can use the RatRef-12 Expression BeadChip to examine the expression of nearly 22,000 rat genes under different experimental conditions. Dr. Robert Thompson of the University of Michigan is using the RatRef-12 BeadChip to examine gene expression in different regions of the rat brain, with the goal of understanding how these regions participate in functions such as memory, emotion, and regulation of the pituitary and endocrine systems. In addition, Thompson is interested

in determining how clinically-used antidepressants can affect these brain functions.

Thompson says, “Due to the larger physical size of the rat compared to the mouse, which allows surgical interventions in rats that are difficult or impossible in mice, and to the historical use of the rat in neurological studies, the rat remains the model of choice for the majority of brain anatomy projects. Our research should profit tremendously through the use of the RatRef-12 BeadChip.”

The RatRef-12 Expression BeadChip contains > 22,500 probes from a total of ~21,900 rat genes. Each BeadChip contains twelve arrays to allow parallel processing of multiple samples. The RatRef-12 BeadChip is constructed with Illumina’s innovative BeadArray™ technology, which was previously used for mouse and human Whole-Genome Expression BeadChips. The oligonucleotide probes in the RatRef-12 BeadChip were selected from rat sequences in the National Center for Biotechnology Information Reference Sequence (NCBI RefSeq) database. Each oligonucleotide contains a 50-base gene-specific probe sequence, as well as a 29-base “address” sequence for BeadChip mapping. The gene-specific probe sequences were determined using a multi step algorithm that considers such parameters as lack of similarity to other gene sequences, the absence of repetitive genomic sequences, self-complementarity, and melting temperature. The oligonucleotide probes are covalently attached to beads, with hundreds of thou-



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— ROBERT THOMPSON, Ph.D.,  
Assistant Professor at the University  
of Michigan



— DOMINIQUE GAUGUIER, Ph.D.,  
Professor of Mammalian Genetics  
at The Wellcome Trust Centre for  
Human Genetics

sands of copies of the same probe immobilized on each bead type. To make the BeadChip, millions of tiny wells are etched into a silicon substrate the size of a microscope slide. When the beads displaying oligonucleotide probes are added to the BeadChip, each bead randomly settles into its own well. Illumina scientists use a fluorescent hybridization-based decoding procedure to map which bead type resides in each well of every BeadChip. Researchers who purchase the RatRef-12 BeadChip can quantitatively probe labeled rat RNA samples for expression of the 21,910 rat gene sequences on the RatRef-12 BeadChip, using the unique map generated for their BeadChip to assign gene sequences.

Illumina's RatRef-12 BeadChip offers many advantages over other rat whole-genome

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expression arrays currently on the market. BeadArray technology insures that each individual BeadChip has been verified during the array mapping process, for 100% quality control. In addition, each probe sequence (i.e., bead type) in the RatRef-12 BeadChip has an average 30-fold redundancy, improving the accuracy and sensitivity of detection. The presence of twelve arrays on each RatRef-12 BeadChip allows parallel processing of multiple samples and controls, minimizing handling and enhancing reproducibility. Moreover, the cost per sample of the RatRef-12 BeadChip is less than half that of other commercially available rat microarrays.

Professor Dominique Gauguier, researcher at the University of Oxford, has used the RatRef-12 BeadChip to investigate genes involved in type 2 diabetes and cardiovascular disease in rat models. Gauguier says, “The Illumina RatRef-12 BeadChip has provided my research with a high-quality and cost- and time-efficient system that can be applied to disease gene discovery and functional characterization of disease variants. Illumina arrays allowed me to capitalize on the experimental models we are developing and expand our transcriptomic studies to multiple insulin-sensitive organs.” Gauguier is particularly impressed by the robustness of the RatRef-12 BeadChip, with its low levels of variability among technical and biological replicates.

Although Thompson's experience with the RatRef-12 BeadChip is preliminary, he predicts that the RatRef-12 BeadChip will greatly benefit his research. He says, “If this rat platform generates gene expression data in a fashion similar to the Illumina mouse array we've used previously, we'll be more confident in our findings, we'll detect more rare RNAs, and we'll be able to discern smaller differences in gene expression than we could with other commercially available arrays. In our preliminary studies using the RatRef-12 BeadChip, we have been very pleased with our ability to process large numbers of samples while still obtaining high-quality array data.”

Despite the nasty reputation of the rat in polite social circles, to researchers like Thompson and Gauguier who use the rat as a model organism, the RatRef-12 BeadChip is a welcome addition to Illumina's family of whole-genome expression BeadChip products.

—by **Laura Cassidy, Ph.D.**  
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**ADDITIONAL INFORMATION**  
To learn more about the RatRef-12 BeadChip, visit our website at [www.illumina.com](http://www.illumina.com).

Go to [www.switchtoi.com](http://www.switchtoi.com) for more information about the Illumina Gene Expression platform.

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