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Infinium® Multi-Use Sample Preparation Kits

A new workflow for streamlined sample preparation and maximized access to new variants from the 1000 Genomes Project.

A New Era of Discovery

The past decade has seen tremendous progress in the field of human genetics. In large part, this has been driven by the application of genome-wide association studies (GWAS), which have identified thousands of common genetic variants associated with human traits and diseases[1]. Thus far, these studies have focused on assessing the role of common variation in disease. However, efforts such as the 1000 Genomes Project (1KGP) are expected to dramatically expand the catalog of known human variants, allowing researchers to explore new hypotheses, including the role of rare variation[2]. To provide customers real-time access to new variants discovered by the 1KGP, Illumina announced the 2010 GWAS Roadmap powered by the Omni family of microarrays. With Omni microarrays, researchers can begin their GWAS now and progressively build to 5M variants per sample.

The GWAS Roadmap is a step-wise path for researchers to begin to explore the role of rarer variants in human health and disease down to 1% MAF. As new variants are released into the public domain, Illumina will incrementally offer customers supplemental chips that provide coverage of the most recent variants from 1KGP. The burden with this approach is that samples must be prepared multiple times in order to add new variants in a stepwise manner. To help streamline this process, Illumina has developed a multi-use workflow protocol that allows researchers to amplify their DNA once upon entry into the Roadmap, and store the aliquot for use on the supplemental Roadmap arrays to build towards 5M markers per sample.

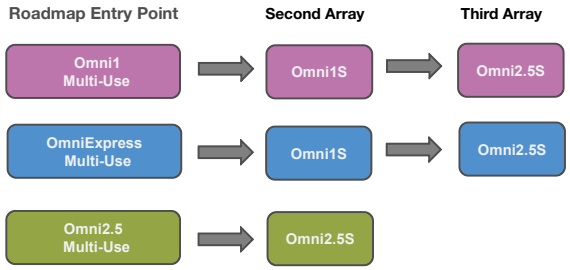
The Path to Five Million Variants Per Sample

Researchers can get started on the Roadmap with the HumanOmni1, HumanOmniExpress, or HumanOmni2.5 BeadChips (Figure 1). Multi-Use Sample Preparation kits are available for each of these Roadmap entry arrays, enabling the addition of new variants with a second or even third array from the Roadmap, while requiring only a single amplification step.

Adding the Omni1S supplemental array to an Omni1 or OmniExpress BeadChip will result in an increase of up to 2.5M markers, providing near complete coverage of common variation and new low frequency variants down to 2.5% minor allele frequency (MAF) in the three main HapMap populations—CEU, YRI, and CHB/JPT*. Adding the Omni2.5S to this combination provides an additional 2.5M markers, delivering comprehensive coverage of rare variants down to 1% MAF.

Alternatively, the Omni2.5 BeadChip delivers ~2.5M variants, including the common tagSNP backbone present on the Omni1 and OmniExpress BeadChips, along with an additional ~1.8M markers designed from 1KGP data. The Omni2.5 will be the first commercial BeadChip to feature high coverage of 1KGP variants down to 2.5% MAF, enabling researchers to embark on a new era of discovery. Starting on the Roadmap with this BeadChip requires multi-use sample preparation so that content from the Omni2.5S supplemental array can be subsequently added to obtain the full 5M markers per sample.

Figure 1: Roadmap Paths to Five Million Variants



Researchers can enter the Roadmap at any one of three points: the OmniExpress, the Omni1, or the Omni2.5 and will get a head start on exploring the new content from the 1KGP. They can expand their research with supplemental arrays as more variants are identified.

DNA Sample Robustness

The multi-use workflow calls for the researcher to amplify the sample once and store the aliquot in a -80°C freezer for use on subsequent Roadmap products. To examine whether any deleterious effects result from prolonged storage, a number of samples were prepared using the Infinium Multi-Use Sample Preparation kits and analyzed on the Omni1 BeadChip. The DNA input requirement for the multi-use kit is 750ng at 50ng/µl. Table 1 shows the averages for key metrics taken from these samples. As expected from Infinium data, all measurements exceeded the product specifications for the BeadChip. After this initial evaluation, the samples were stored at -80°C for six months. Upon thawing, the samples were again analyzed on a fresh Omni1 BeadChip. As shown in Table 1, none of the key metrics diminished on second usage of the samples following the six-month storage period. These results indicate that Infinium DNA samples can be stored for extended time periods and reused with no negative effects to the assay data quality when following the multi-use workflow protocol.

Automation

Illumina Laboratory Information Management System (LIMS) and robotic automation capabilities are available for the Multi-Use Sample Preparation kits. Together, these systems accurately and efficiently track samples and allow labs to maximize their throughput with a completely integrated workflow automation solution.

* CEU: CEPH Utah; CHB: Chinese Han Bejing; JPT: Japanese Toyko; YRI: Yoruban

Table 1: DNA Sample Stability Metrics

Metric	Product Spec.	0-Month Measurement	6-Month Measurement
Avg. Call Rate	> 99%	99.7%	99.6%
Log R Dev	< 0.20	0.17	0.19
Reproducibility	> 99.9%	> 99.9%	> 99.9%
Heritability	> 99.5%	> 99.9%	99.9%
HapMap Concordance	> 99.5%	99.7%	99.7%
Infinium BeadChip Concordance	> 99.9%	> 99.9%	> 99.9%

The Infinium HD assay produces the industry's highest quality data, consistently providing call rates of greater than 99%. For customers on the GWAS Roadmap, the Infinium Multi-Use Sample Preparation kits enable DNA samples to be prepared once and then reused multiple times for analyzing additional variants, while retaining excellent data quality. The above table shows that genotype quality metrics did not diminish for a set of prepared DNA samples that were stored at -80°C and reused after a six-month period.

Summary

The 2010 GWAS Roadmap for the Omni family of microarrays provides researchers with the fastest access to new variants discovered by the 1KGP. Researchers can begin GWAS immediately and add new variants to their project as they become available. Samples for these studies can be prepared initially and then stored until new variants are added to the study at a later time. Using the Infinium Multi-Use Sample Preparation kit, the samples will continually produce high assay data quality over multiple usages.

References

1. Manolio T, Collins F, Cox N, Goldstein D, Hindorff L, et al. (2009) Finding the missing heritability of complex diseases. Nature 461: 747–753.
2. www.1000genomes.org

Multi-Use Sample Preparation Kits

Product	Kit Configuration	Catalog No.
HumanOmni1-Quadv1.0 DNA Analysis Kit Multi-Use	16 samples	WG-311-1123-PRE
	96 samples	WG-311-1124-PRE
HumanOmniExpress-12v1.0 DNA Analysis Kit Multi-Use	48 samples	WG-311-1125-PRE
	288 samples	WG-311-1126-PRE
HumanOmni1S DNA Analysis Kit Multi-Use	16 samples	WG-311-1129-PRE
	96 samples	WG-311-1130-PRE
HumanOmni2.5 DNA Analysis Kit Multi-Use	16 samples	WG-311-1127-PRE
	96 samples	WG-311-1128-PRE
HumanOmni2.5S DNA Analysis Kit Multi-Use	16 samples	WG-311-2509-PRE
	96 samples	WG-311-2510-PRE

Illumina, Inc. • 9885 Towne Centre Drive, San Diego, CA 92121 USA • 1.800.809.4566 toll-free • 1.858.202.4566 tel • techsupport@illumina.com • illumina.com

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