Droplet Digital PCR System Allows Researchers to Study Biological Systems with Unprecedented Precision

The ability to detect “rare events” such as single nucleotide mutations is important in disease research. Their early detection can dramatically improve the outcomes of cancer patients. In addition, being able to discriminate small differences in target concentration can help researchers study the plethora of copy number variations (CNVs) that are implicated in disease.

Bio-Rad Laboratories, Inc.’s QX100 Droplet Digital PCR (ddPCR) system provides an absolute measure of target DNA molecules with unrivaled accuracy, precision and sensitivity. Applications include rare event detection, copy number variation, and gene expression analysis. The QX100 ddPCR system provides single copy PCR resolution to accelerate discoveries and offers a new approach for the research of inherited disorders, cancer and infectious disease.

HOW IT WORKS

Droplet Digital PCR partitions the nucleic acid sample into approximately 20,000 droplets, with target and background DNA randomly distributed among them. After PCR amplification occurs, a reader determines which droplets contain a target (+) and which do not (-). Software calculates the concentration of target DNA as copies per microliter.

APPLICATIONS

Researchers have been applying the precision, accuracy and sensitivity of the QX100 ddPCR system to a range of applications, including rare event detection and copy number variation (CNV).

Rare events includes single nucleotide mutation, alteration of copy number, and deletion or insertion of nucleotides. For rare event detection, partitioning increases sensitivity by isolating the target signal from competing background.

Droplet Digital PCR offers a practical solution for the precise estimate of DNA copy number. The QX100 can detect amplifications even in highly heterogeneous matrices where only a fraction of the cells are affected. This precision enables the detection of somatic copy number alteration—the hallmark of many cancers.

The detection of point mutations requires a high degree of sensitivity. Droplet Digital PCR allows the detection of 0.001% mutation fractions, which could lead to dramatically more sensitive and less invasive diagnostics.

Copy number variants include deletions, insertions, duplications, and complex amplifications. For CNV, the large number of replicates made possible by sample partitioning provides the precision necessary to resolve high-order copy number states. Progress has been made identifying CNVs using arrays and deep sequencing methods, but validation options are severely limited.

The QX100 ddPCR system offers an ideal solution for CNV validation while delivering the necessary throughput and cost efficiency. Employing Droplet Digital PCR, researchers have been able to completely resolve copy number variations, distinguish less than 50% differences in gene copy, and accurately count genes that differed by only one nucleotide.