Accelerating the future of liquid biopsy

Ultra-low mutation detection solutions from sample prep to data analysis

ThermoFisher SCIENTIFIC

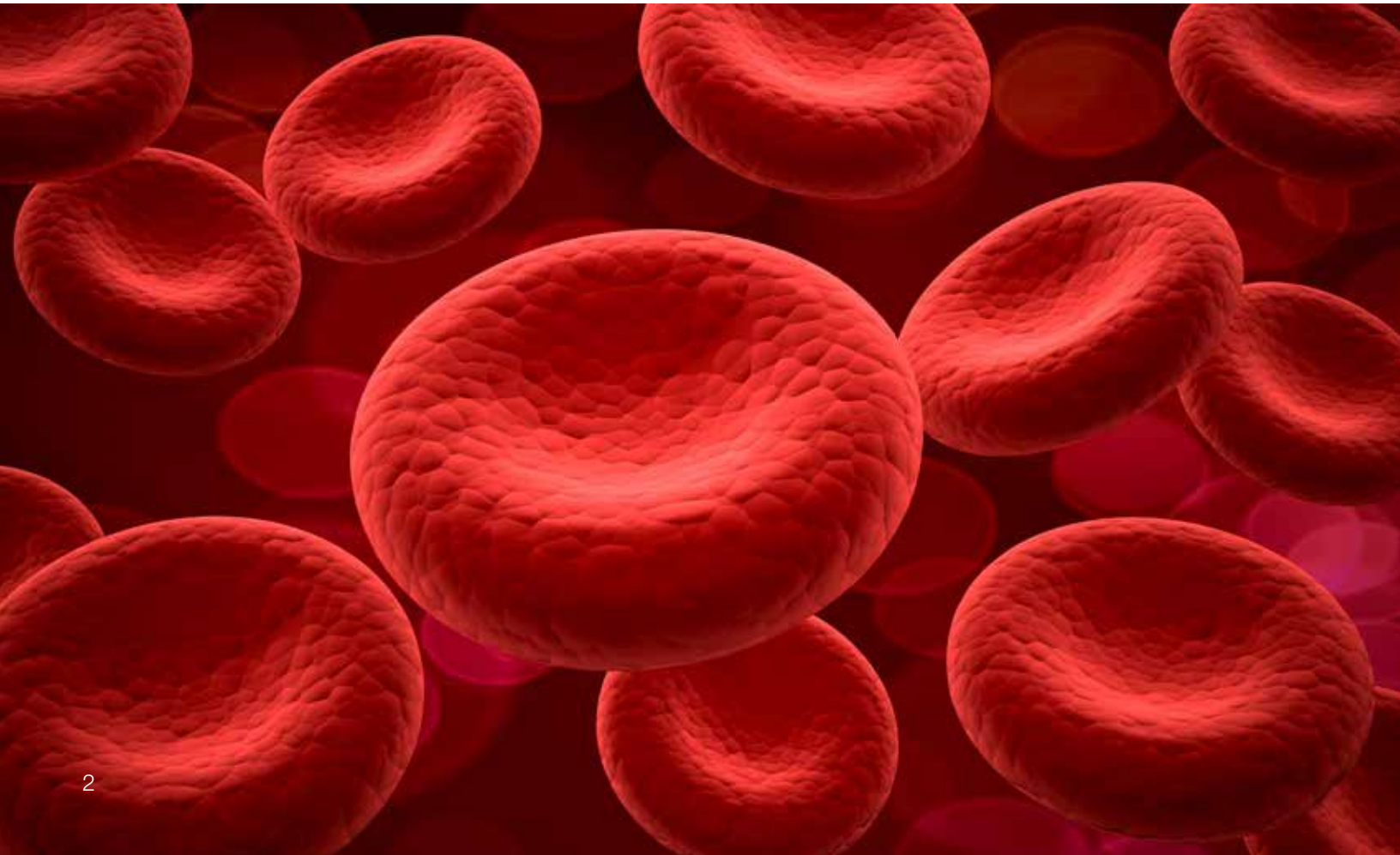
The exciting potential of liquid biopsy in oncology research

Currently, the most common strategy for characterizing the genetic makeup of a tumor is the extraction, or biopsy, of a sample of the affected tissue. Tissue biopsies, however, can be painful, risky, and in some cases not feasible when a tumor is difficult to access. Furthermore, tissue biopsies are not a viable monitoring technique as they cannot be repeated, and they may not be representative of the entire tumor due to tumor heterogeneity.

Liquid biopsy is an emerging area of clinical research, particularly in the context of cancer. As a minimally invasive complementary or alternative approach to tissue biopsies, liquid biopsies are less risky, painful, and costly, and are increasingly being used to analyze biomarkers in liquid samples, such as blood.

Recent studies have shown the utility of liquid biopsies for:

- Enhancing understanding of tumorigenesis, metastasis, and therapy resistance
- Detection of cancer at early stages when treatment may be most successful
- Monitoring of cancer development, disease progression, and recurrence
- Tracking response or resistance during and after treatment to allow for adjustments in real time



Unlock the potential in your liquid biopsy samples

MagMAX cell-free nucleic acid isolation kits

Liquid biopsies most often utilize cell-free DNA (cfDNA) that is derived from both normal and cancerous cells. The tumor-only supply of DNA in the bloodstream is more commonly referred to as circulating tumor DNA (ctDNA), which is loaded with information about a tumor that would otherwise be difficult to access. The first step in obtaining this valuable information is efficient nucleic acid isolation that specifically recovers the fragmented cfDNA while leaving the larger DNA molecules behind. This aspect of enrichment for the cfDNA portion of the total nucleic acid ensures that the shorter, ctDNA is concentrated and ready for downstream analysis using qPCR, digital PCR (dPCR), or next-generation sequencing (NGS).

The Applied Biosystems™ MagMax™ Cell-Free DNA and Cell-Free Total Nucleic Acid Isolation Kits use magnetic bead–based technology to purify enriched cfDNA or cell-free total nucleic acids, without genomic DNA (gDNA) contamination, from plasma, serum, or urine samples. To help save time and increase reproducibility, combine these kits with Thermo Scientific™ KingFisher™ instruments for automated purification.

MagMAX Cell-Free DNA Isolation Kit

- Yields cfDNA with no gDNA contamination
- Flexible sample input from 500 µL to 10 mL
- Elution volumes ranging from 15 to 100 µL
- Phenol-free extraction
- Process 24 samples in 45–60 minutes when used with KingFisher instruments

MagMAX Cell-Free Total Nucleic Acid Isolation Kit

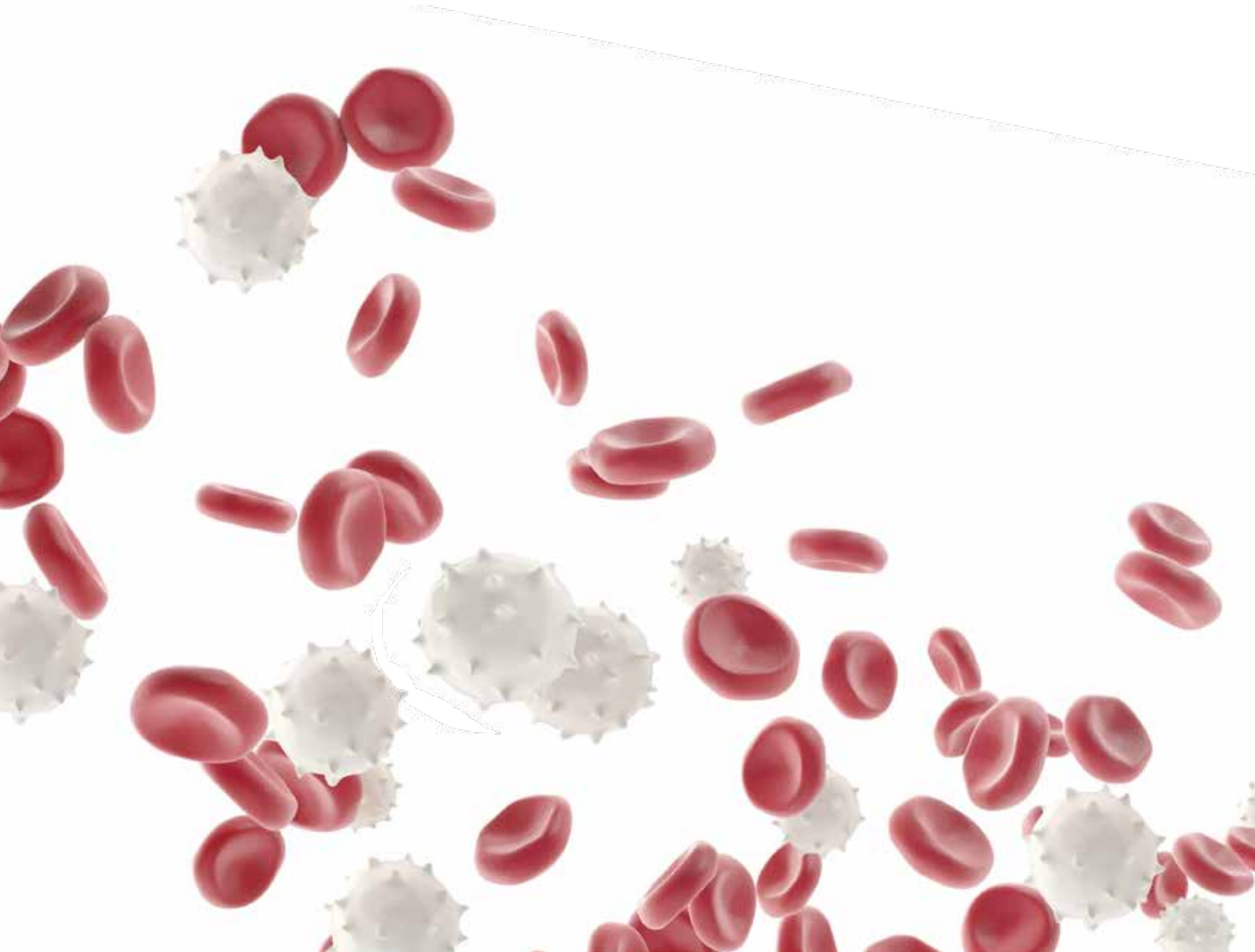
- Purify free-circulating DNA, RNA, and miRNA with no gDNA contamination
- Flexible sample input from 1 to 6 mL
- Elution volumes ranging from 15 to 60 µL
- Phenol-free extraction
- Process 24 samples in 90 minutes or less when used with KingFisher instruments

Find out more at
thermofisher.com/magmaxcfdna

Using NGS and dPCR together for improved liquid biopsy analysis

Liquid biopsy analysis requires highly sensitive assays that can detect relatively small quantities of highly fragmented tumor-derived DNA and RNA found in blood. Two of the most common techniques are NGS and dPCR. While each can be an ideal solution under certain circumstances, recent studies suggest they often work better together—the wide-angle view provided by NGS combined with dPCR's zoomed-in precision detection provides a more complete picture of the cancer genome.

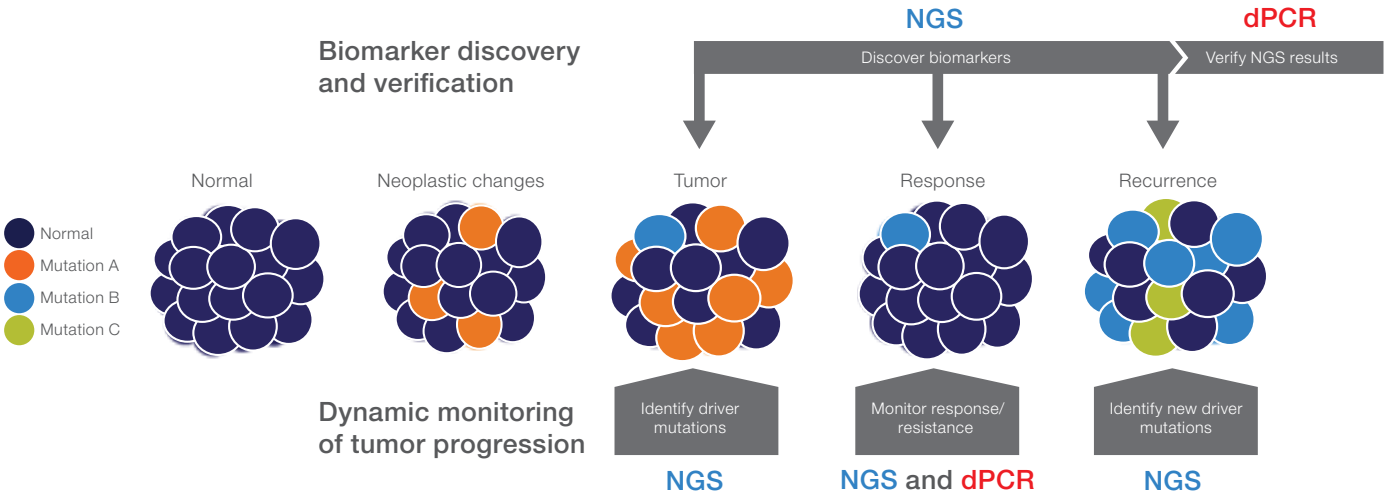
We are committed to developing high-quality liquid biopsy assays utilizing both dPCR and targeted NGS technologies to enable the identification and monitoring of cancer driver and resistance mutations, and recurrence detection. Through the powerful combination of targeted NGS assays, which provide comprehensive detection of cancer-related mutations, and dPCR assays, which offer identification of a targeted set of mutations, liquid biopsies may soon become the standard in cancer management.



NGS and dPCR liquid biopsy solutions

For discovery and the study of resistance and recurrence

Biomarker discovery	Biomarker verification
Analyze cfDNA and cell-free RNA (cfRNA) with ultrasensitive, fully customizable panels or predesigned NGS assays to discover potential cancer biomarkers	Orthogonally verify biomarker discovery results using dPCR assays



Identify cancer driver and resistance mutations	Monitor response and resistance	Discover new potential driver mutations at recurrence
Analyze cfDNA and cfRNA to identify primary cancer driver and resistance mutations, using targeted NGS solutions	Study response and resistance by monitoring cancer driver and resistance mutations using either dPCR (for few mutations) or NGS assays (for many mutations)	Identify new potential cancer driver and resistance mutations related to recurrence, using targeted NGS solutions

The power of multibiomarker NGS solutions for liquid biopsy analysis

AmpliSeq HD technology and Oncomine cell-free nucleic acid assays

Ion Torrent™ AmpliSeq™ HD technology uses molecular tags, or UMTs, to deliver results with ultrahigh sensitivity. With AmpliSeq HD technology, you have the power to design your own custom gene panels and find variants at very low limits of detection.

- **Low limit of detection**—variant detection down to 0.1%
- **Easy and convenient customization**—flexible panel customization using Ion AmpliSeq™ Designer software
- **Complete 2-day workflow**—fast, targeted-NGS workflow from sample to data

Find out more at **thermofisher.com/ampliseqhd**

Ion Torrent™ Oncomine™ cell-free nucleic acid assays are predesigned, multibiomarker NGS assays that enable the identification and monitoring of cancer driver and resistance mutations from cfDNA and cfRNA simultaneously, down to 0.1% allelic frequency. The high-value gene content includes targets selected and verified by the OncoNetwork consortium and clinical researchers around the world.

- **Optimized content**—SNVs, indels, CNVs, and fusions
- **Low limit of detection**—variant detection down to 0.1%
- **Flexible input amounts**—results enabled from one tube of blood
- **Streamlined workflow**—complete NGS workflow, from sample to data, in just 2–3 days

Find out more at **thermofisher.com/cfna-assays**

Lung				Breast				Colon		
Oncomine Lung cfDNA Assay		**Oncomine Lung Cell-Free Total Nucleic Acid Assay**		**Oncomine Breast cfDNA Assay**		**Oncomine Breast cfDNA Assay v2**		**Oncomine Colon cfDNA Assay**		
ALK	*MET*	*ALK*	*MET*	*AKT1*	*FBXW7*	*AKT1*	*FBXW7*	*AKT1*	*ERBB2*	*NRAS*
BRAF	*NRAS*	*BRAF*	*NRAS*	*EGFR*	*KRAS*	***CCND1***	***FGFR1***	*APC*	*FBXW7*	*PIK3CA*
EGFR	*PIK3CA*	*EGFR*	*PIK3CA*	*ERBB2*	*PIK3CA*	*EGFR*	*KRAS*	*BRAF*	*GNAS*	*SMAD4*
ERBB2	*ROS1*	*ERBB2*	***RET***	*ERBB3*	*SF3B1*	*ERBB2*	*PIK3CA*	*CTNNB1*	*KRAS*	*TP53*
KRAS	*TP53*	*KRAS*	*ROS1*	*ESR1*	*TP53*	*ERBB3*	*SF3B1*	*EGFR*	*MAP2K1*	
MAP2K1		*MAP2K1*	*TP53*			*ESR1*	*TP53*			

Pan-cancer									
Oncomine Pan-Cancer Cell-Free Assay									
Hotspot genes					**Tumor suppressor genes**	**CNV genes**		**Gene fusions**	
AKT1	*EGFR*	*FLT3*	*KRAS*	*PDGFRA*	*APC*	*CCND1*	*ERBB2*	*ALK*	*FGFR3*
ALK	*ERBB2*	*GNA11*	*MAP2K1*	*PIK3CA*	*FBXW7*	*CCND2*	*FGFR1*	*BRAF*	*MET*
AR	*ERBB3*	*GNAQ*	*MAP2K2*	*RAF1*	*PTEN*	*CCND3*	*FGFR2*	*ERG*	*NTRK1*
ARAF	*ESR1*	*GNAS*	*MET*	*RET*	*TP53*	*CDK4*	*FGFR3*	*ETV1*	*NTRK3*
BRAF	*FGFR1*	*HRAS*	*MTOR*	*ROS1*		*CDK6*	*MET*	*FGFR1*	*RET*
CHEK2	*FGFR2*	*IDH1*	*NRAS*	*SF3B1*		*EGFR*	*MYC*	*FGFR2*	*ROS1*
CTNNB1	*FGFR3*	*IDH2*	*NTRK1*	*SMAD4*					
DDR2	*FGFR4*	*KIT*	*NTRK3*	*SMO*					

Content in Oncomine cell-free nucleic acid assays. Select from five focused, tumor-specific assays predesigned with key gene content, or a broad pan-cancer assay that covers all classes of mutations across 18 different cancer types. Additional genes included in new assays are in bold.

Use dPCR to study response and resistance

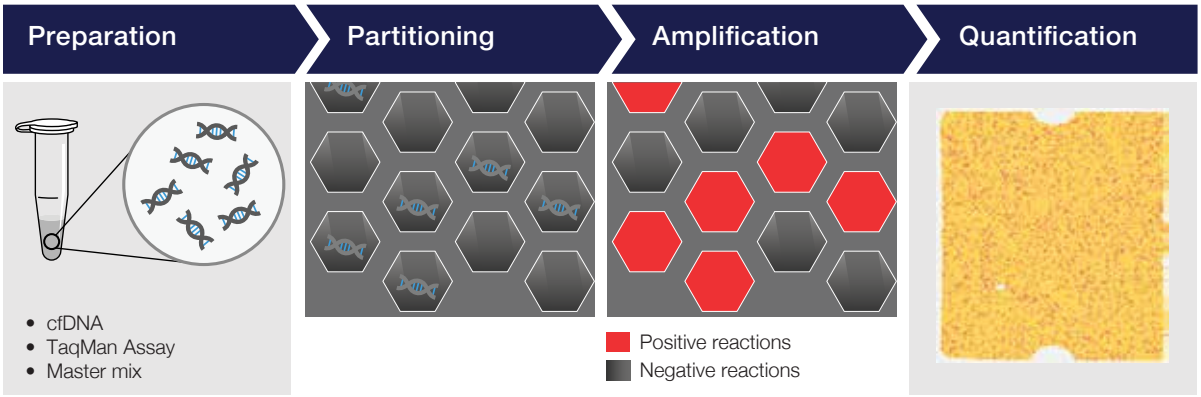
TaqMan Liquid Biopsy dPCR Assays

The Applied Biosystems™ TaqMan® Liquid Biopsy dPCR Assays provide a precise, cost-effective, and rapid method for the detection and quantification of common cancer-related and resistance mutations, making them ideal for the study of response and resistance. They have been wet-lab verified and are guaranteed* to perform on the Applied Biosystems™ QuantStudio™ 3D Digital PCR System and on other dPCR and droplet digital (ddPCR) instruments, including the Bio-Rad™ QX100™ and QX200™ systems.**

* Terms and conditions apply. For complete details, go to **www.thermofisher.com/taqmanguarantee**.

** These statements have not been reviewed or endorsed by Bio-Rad.

- **Optimized dPCR performance**—wet-lab verified TaqMan Assays targeting over 100 common cancer mutations, including markers for non-small cell lung cancer (NSCLC), breast cancer, and colorectal cancer (CRC)
- **Highly sensitive**—detect and quantify rare mutant prevalence down to 0.1%
- **Cost-effective, single-tube assay**—single-tube format includes both wild type and mutant alleles
- **Guaranteed performance**—backed by the TaqMan Assay performance guarantee*
- **Streamlined analysis**—enhanced bioinformatics tools for better quantification of rare mutations



TaqMan dPCR assays enable absolute quantification of target alleles. To perform dPCR, a nucleic acid mixture is partitioned into many reaction wells, such that some wells receive a target molecule and some do not. Reactions are subjected to standard PCR to identify wells that have not received target molecules. A standard statistical correction model accounts for wells that may have received more than a single target molecule, and a final concentration value is produced.

Find out more at
thermofisher.com/digitalpcrliquidbiopsy

Liquid biopsy solutions

Ordering information

Product	Cat. No.
Sample preparation	
MagMAX Cell-Free Total Nucleic Acid Isolation Kit	A36716
MagMAX Cell-Free DNA Isolation Kit	A29319
QuantStudio 3D Digital PCR Master Mix v2, 5 mL	A26359
Mutation detection	
TaqMan Liquid Biopsy dPCR Assays	A44177
QuantStudio 3D Digital PCR Instrument	4489084
Ion AmpliSeq HD Made-to-Order Panels	Design on **ampliseq.com**
Oncomine Pan-Cancer Cell-Free Assay	A37664
Oncomine Lung Cell-Free Total Nucleic Acid Assay	A35864
Oncomine Lung cfDNA Assay	A31149
Oncomine Breast cfDNA Assay v2	A35865
Oncomine Breast cfDNA Assay	A31183
Oncomine Colon cfDNA Assay	A31182
Ion GeneStudio S5 Prime System	A38196
Ion GeneStudio S5 Plus System	A38195
Ion GeneStudio S5 System	A38194
Ion Chef Instrument	4484177
Data analysis and reporting	
QuantStudio 3D Analysis Suite Cloud Software	Access online
Ion Reporter Server System	4487118

Learn more about our complete suite of liquid biopsy solutions at **thermofisher.com/liquidbiopsy**

ThermoFisher SCIENTIFIC