

OpenArray technology on the QuantStudio 12K Flex Real-Time PCR System

High-throughput profiling, confirmation, and screening in a mid-density format

- Fast—generate over 43,000 expression profiles, or more than 110,000 genotypes, per workday without robotics
- High-throughput—screen over 5,184 genotyping samples, or more than 2,304 expression samples per workday
- Economical—save precious samples and reduce reagent costs through cost-effective use of nanoliter volumes

Introduction

Applied Biosystems™ OpenArray™ technology on the Applied Biosystems™ QuantStudio™ 12K Flex Real-Time PCR System accelerates genomic confirmation and screening, enabling unprecedented gene coverage and sample throughput. With OpenArray technology on the QuantStudio 12K Flex system, a single user can now easily complete most projects in days instead of weeks, and generate from 1 to over 12,000 data points in a single run. A broad selection of predesigned, flexible, and custom plate formats are available to meet the specific needs of a wide spectrum of research applications.

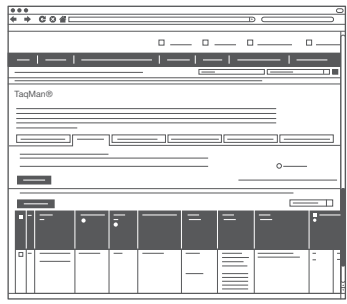
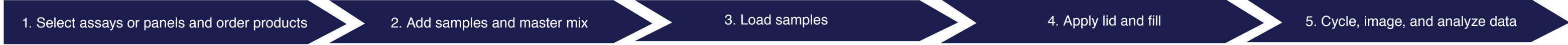
The Applied Biosystems™ QuantStudio™ 12K Flex OpenArray™ plates have an easy-to-use format. For most



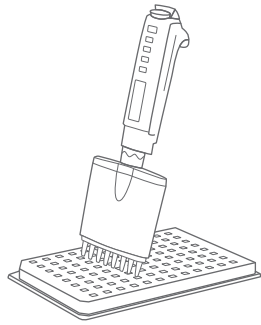
The QuantStudio 12K Flex Real-Time PCR System

applications, assays are preloaded onto plates at our state-of-the-art manufacturing facility. To run the plates, simply mix your sample with master mix, load with the automated Applied Biosystems™ QuantStudio™ 12K Flex OpenArray™ AccuFill™ System (Table 1), cycle, and image (Figure 1).

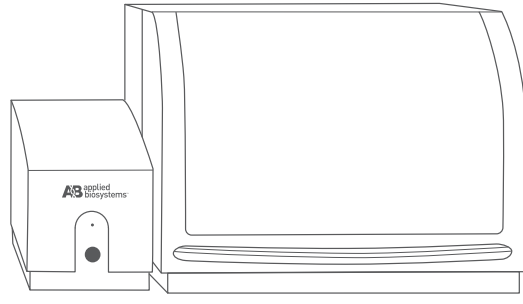
The self-metering nanofluidic design of the QuantStudio 12K Flex OpenArray plates uses only 33 nL of reaction per data point. This significantly minimizes reagents and costs while still delivering high performance (Tables 2–4) and the reproducibility to trust your results.



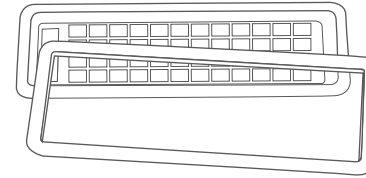
Go to thermofisher.com/openarray to select assays and design your custom OpenArray plates, or to select from predesigned OpenArray Fixed- and Flexible-Content Panels.



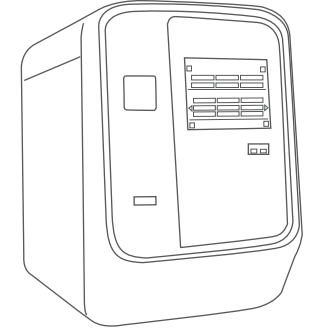
For gene expression and genotyping applications, mix cDNA or DNA samples with master mix in 384-well sample plates. For digital PCR applications, mix assays, samples, and master mix in 384-well sample plates.



Load sample mixes onto a QuantStudio 12K Flex OpenArray plate with the QuantStudio 12K Flex AccuFill System.



The QuantStudio 12K Flex OpenArray plate is encased in an alloy bottom for easy handling; simply apply the adhesive lid and fill the case with immersion fluid.



Easily run up to four QuantStudio 12K Flex OpenArray plates for any application on the QuantStudio 12K Flex instrument in stand-alone mode.

Figure 1. The OpenArray workflow on the QuantStudio 12K Flex Real-Time PCR System.

Custom offerings of QuantStudio 12K Flex OpenArray plates include a suite of 11 formats (Tables 5 and 6) to provide flexible solutions to configure your plates for gene expression analysis and genotyping. Off-the-shelf, predesigned QuantStudio 12K Flex OpenArray Real-Time PCR fixed-content panels are also available. You can choose from a variety of pathways such as signal transduction, kinome, and inflammation, as well as stem cell, cancer, genetic barcoding, and pharmacogenomics panels. Digital PCR applications use Applied Biosystems™ TaqMan™ Assay chemistry in open-format Applied Biosystems™ QuantStudio™ 12K Flex TaqMan™ OpenArray™ Digital PCR Plates.

OpenArray technology accelerates and enables many high-throughput research applications

OpenArray technology helps streamline real-time PCR studies that use large numbers of samples, assays, or both, as a single QuantStudio 12K Flex OpenArray plate is equivalent to running eight traditional 384-well plates. The system can run up to four QuantStudio 12K Flex OpenArray plates simultaneously, allowing you to process up to 1,728 genotyping samples and 2,304 samples for gene expression in an 8-hour day. Enhance your genotyping throughput by thermal cycling offline using the

Applied Biosystems™ ProFlex™ 2 x Flat Block PCR System, and process a total of over 5,184 genotyping samples in one day.

Drug discovery

TaqMan Assay chemistry is routinely used to confirm microarray results and screen large numbers of samples in biomarker, genotyping, and toxicology projects. The OpenArray technology is used in the drug discovery environment to streamline confirmation and screening efforts (Figure 2).

Pharmaceutical target confirmation

When you need to test tens to hundreds of genes against tens to thousands of samples, OpenArray technology is the way to go. The ability to easily switch from microtiter plates to QuantStudio 12K Flex OpenArray plates on a single system allows continuity of data analysis as well as significant cost reduction.

MicroRNA profiling

OpenArray technology is ideal for human and rodent microRNA (miRNA) profiling studies. Combined with up-front sample preparation using Applied Biosystems™ Megaplex™ Primer Pools to streamline conversion of miRNA to cDNA, and preamplification prior to

quantification, Applied Biosystems™ TaqMan™ OpenArray™ MicroRNA Panels deliver Applied Biosystems™ TaqMan™ MicroRNA Assay performance with superior throughput. These panels can be used to profile up to 36 samples per day and offer researchers a fast, easy, and affordable path to validated data.

Agricultural molecular testing

OpenArray technology can be used to detect viral, fungal, and bacterial pathogens. The flexibility of OpenArray technology allows agricultural diagnostics researchers to very quickly add new pathogens to their hit lists, and to test more than 760 samples in triplicate in just one day.

OpenArray technology is also used to select crop seed lines, in fine-mapping studies, and in quantitative trait locus (QTL) mapping—for broad animal tracking and trait selection.

Table 1. Specifications for the QuantStudio 12K Flex OpenArray AccuFill System.

Fill rate	99.25%
Maximum allowable sample carryover	<1%
Maximum allowable assay carryover	<1%
Maximum number of through-hole data points lost due to evaporation	<5%

Table 2. Performance specifications for QuantStudio 12K Flex TaqMan OpenArray Real-Time PCR Plates.

Specificity based on no-template control	No demonstrable amplification
Precision of replicates at 100 copies	Standard dev. for C _t : <0.25
No amplification in empty holes	>99% holes
Loading time for 4 OpenArray plates (12,288 reactions)	<20 minutes
Time from cDNA or DNA to real-time data	~2.5 hours
Throughput of one technician in one day	>43,000 reactions (up to 2,304 samples)

Table 3. Performance specifications for QuantStudio 12K Flex TaqMan OpenArray Genotyping Plates.

Assay conversion rate from a 7900HT Real-Time PCR System	>95%*
Concordance with assays run on a 7900HT Real-Time PCR System	99.7%*
Call rate	>99%*
Number of haploid copies of gDNA/through-hole	250
TaqMan OpenArray Genotyping Plate capacity per 8-hour day by a single person	36**
Time from purified DNA to genotyping data	~5 hours
Throughput of one technician in one day	110,000**

* Individual performance is dependent on end user's sample integrity and purity.

** Combination of one instrument run with a ProFlex 2 x Flat Block PCR System (optional).

Table 4. Performance specifications for QuantStudio 12K Flex TaqMan OpenArray Digital PCR Plates.

Available real estate	3,072 through-holes (up to 144 digital PCR answers per run)
Time from sample to answer	~3 hours
Throughput of one technician in one day	>49,000 data points (up to 576 dilutions or samples)
False-negative/false-positive rate	<5%

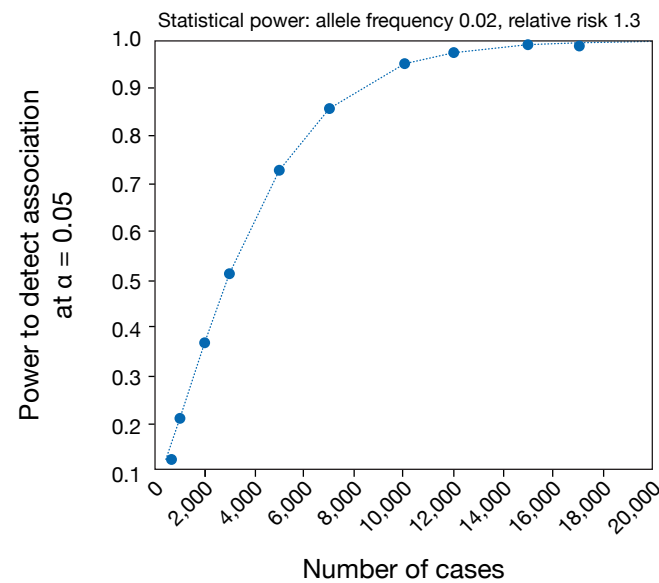


Figure 2. More samples mean greater statistical power: the larger the sample size, the more confidence you have in detecting a real effect. OpenArray technology helps provide the high throughput and low cost needed for high-powered confirmation or screening studies.

Digital PCR

OpenArray technology can be used for digital PCR applications such as accurate, traceable quantification of viral load, sensitive detection of mutant sequences against backgrounds of somatic wild type DNA, and GMO quality control. When you need to rescue ambiguous qPCR data, QuantStudio 12K Flex TaqMan OpenArray Digital PCR Plates help deliver precise, absolute answers. The open format of the plate facilitates experimental design, allowing multiple sample dilutions for increased input dynamic range (Figure 3).

Rapid and cost-effective analysis with fixed-content panels

Quickly understand which genetic changes may have biological significance, with cost-effective Applied Biosystems™ OpenArray™ fixed-content panels. These panels are preconfigured with Applied Biosystems™ TaqMan™ Gene Expression or SNP Genotyping Assays for specific biological processes, pathways, or disease states. With 1- to 2-day shipping and no minimum orders, these assays allow for accurate, efficient, and cost-effective assessment of a specific pathway (Table 7) across hundreds to thousands of samples in a single day.

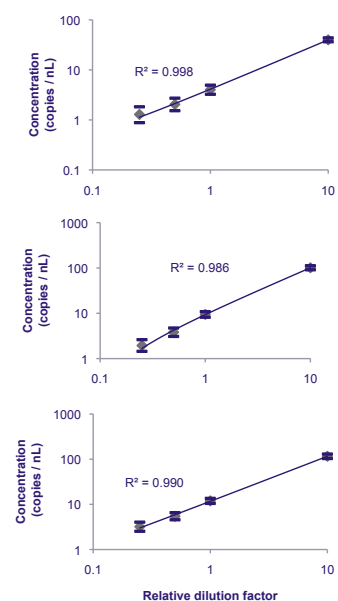
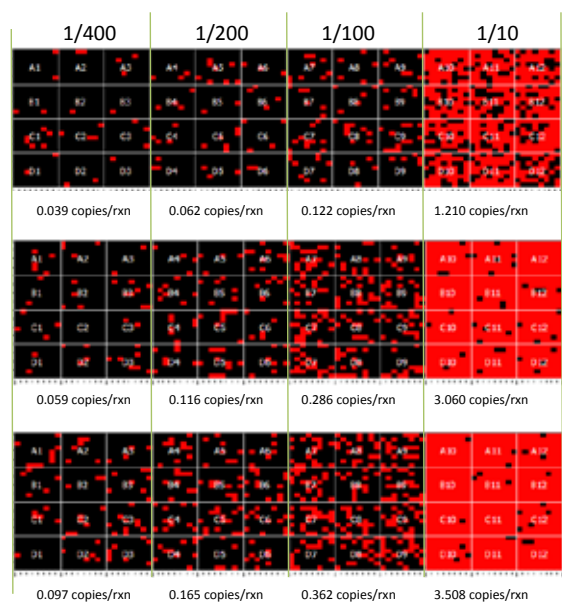


Figure 3. Serial dilutions of DNA across QuantStudio 12K Flex TaqMan OpenArray Digital PCR Plates. Dilution series of Applied Biosystems™ AcroMetrix™ standards for the dsDNA viruses—Epstein-Barr virus, cytomegalovirus, and BK virus—were evaluated using digital PCR. The viral standards were diluted as indicated and quantified using TaqMan OpenArray Digital PCR Plates. For each dilution set, digital PCR reactions were run in 12 subarrays, each containing 64 through-holes, for 768 replicates per sample (heat maps on left). The graphs on the right show the linearity and precision of target detection.

Table 5. QuantStudio 12K Flex OpenArray Gene Expression Plate format options.

Plate format	Samples/plate	Minimum order (10 pack)	
		Inventoried assays only	Inventoried, pre-designed, and custom assays
18 (3x) assays	48	1	1
56 assays	48	1	1
112 assays	24	1	2
168 assays	16	1	3
224 assays	12	1	4

Table 6. QuantStudio 12K Flex TaqMan OpenArray Genotyping Plate format options.

Plate format	Samples/plate	Minimum order (10 pack)
16 assays	144	1
32 assays	96	1
64 assays	48	2
128 assays	24	4
192 assays	16	6
256 assays	12	8

Table 7. Types of fixed-content panels available for OpenArray analysis on the QuantStudio 12K Flex Real-Time PCR System.

Panels	Description
Genetic barcode	
Human stem cell	
MicroRNA (human or rodent)	
Inflammation (human or mouse)	
Human kinome	
Human signal transduction	
Human cancer	
Pharmacogenomics (PGx)	

A complete, scalable, and economical solution

OpenArray technology on the QuantStudio 12K Flex system is an affordable solution for high-throughput gene expression, genotyping, miRNA, and digital PCR applications. This unique technology minimizes reagent use and helps greatly decrease the price per data point, so more samples can be run on the same budget. Additionally, there are no setup charges or other hidden fees.

The QuantStudio 12K Flex system empowers you to perform a wide range of experiments. You can scale from low-throughput feasibility studies to high-throughput screens with a single platform by bundling your system with up to 5 interchangeable thermal cycling blocks.

Accelerate your genotyping— with an optional flat block thermal cycler

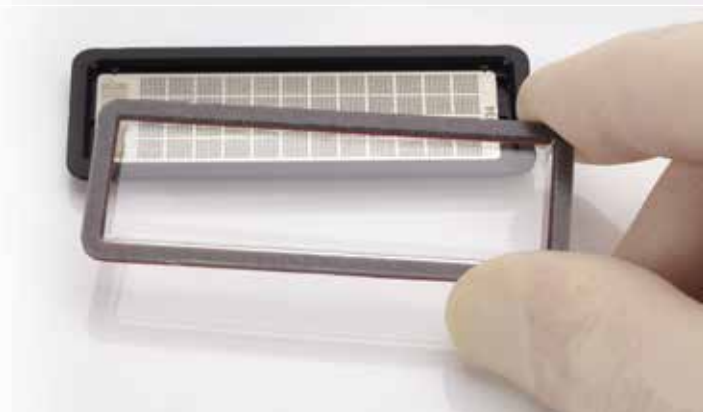
Developed for use in genotyping applications where sample throughput is of the utmost importance, the ProFlex 2 x Flat Block PCR System can thermal-cycle up to eight Applied Biosystems™ QuantStudio™ 12K Flex TaqMan™ OpenArray™ Genotyping Plates simultaneously. This system offers interchangeable blocks to switch to standard multi-well plate formats. The Applied Biosystems™ ProFlex™ instrument is optional and sold separately from the QuantStudio 12K Flex system.

Comprehensive coverage with TaqMan Assays

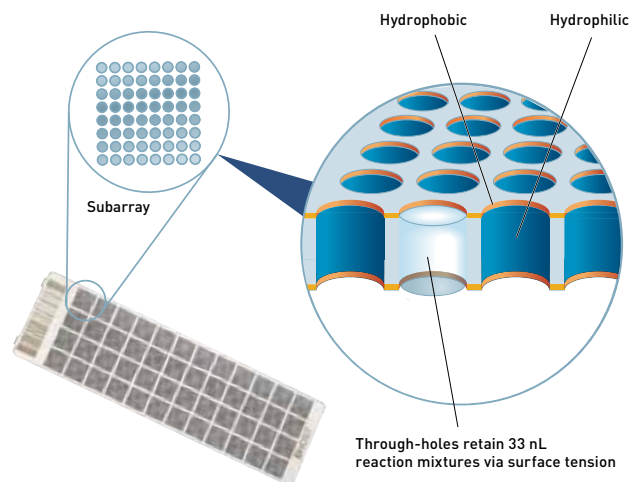
We offer over 61,000 inventoried TaqMan Gene Expression Assays and over 7 million predesigned genotyping assays, including assays for 3.5 million HapMap SNPs and 2,700 inventoried drug-metabolizing enzymes (DME), for use with QuantStudio 12K Flex OpenArray plates. Over 750 TaqMan MicroRNA Assays are available as predefined sets in QuantStudio 12K Flex OpenArray MicroRNA Panels. Additionally, you can create Applied Biosystems™ Custom TaqMan™ Gene Expression or SNP Genotyping Assays by submitting your target sequences at thermofisher.com/cadt

OpenArray technology

OpenArray technology is a broadly applicable nanoliter fluidics platform for low-volume, solution-phase reactions. Researchers using this technology benefit from the parallelism of microarrays and the data quality of PCR-based solution-phase reactions.



OpenArray technology utilizes a microscope slide–sized plate with 3,072 through-holes. Each plate contains 48 subarrays with 64 through-holes. Each through-hole is 300 µm in diameter and 300 µm in depth.



OpenArray plate anatomy. Each through-hole is coated with hydrophilic and hydrophobic coatings. Reagents are retained in the through-holes via surface tension. QuantStudio 12K Flex OpenArray plates come encased with an alloy bottom, so there is no need to touch the array. Simply apply the adhesive lid and fill the case with immersion fluid.

Ordering information

Product	Quantity	Cat. No.
OpenArray instrumentation and accessories		
QuantStudio 12K Flex Real-Time PCR System, Desktop Configuration. Includes QuantStudio 12K Flex Real-Time PCR Instrument, QuantStudio 12K Flex OpenArray AccuFill System, OpenArray thermal cycling block, computer/monitor, analysis software, installation, basic training at the time of installation, and 1-year warranty	1 system	4471090
QuantStudio 12K Flex OpenArray AccuFill System	1 system	4471021
QuantStudio 12K Flex AccuFill Upgrade Kit	1 module	4471022
QuantStudio 12K Flex Real-Time PCR System, OpenArray Block without AccuFill System	1 instrument	4472380
Optional instrument accessories		
ProFlex 2x Flat Block PCR System	1 system	4484078
QuantStudio 12K Flex OpenArray Block Upgrade with AccuFill System	1	4471067
Starter kits		
QuantStudio 12K Flex TaqMan OpenArray Genotyping Starter Kit	1 kit	4469605
QuantStudio 12K Flex TaqMan OpenArray Gene Expression Starter Kit	1 kit	4469604
QuantStudio 12K Flex TaqMan OpenArray Human miRNA Starter Kit	1 kit	4469606
QuantStudio 12K Flex TaqMan OpenArray Digital PCR Starter Kit	1 kit	4469607
Practice kits		
QuantStudio 12K Flex OpenArray Practice Kit. Includes 6 loading plates, QuantStudio 12K Flex TaqMan OpenArray Starter Accessories Kit, OpenArray AccuFill System tips, 384-well sample plates and loading plate, and TaqMan OpenArray Genotyping Master Mix	1 kit	4469620
Calibration kits		
QuantStudio 12K Flex OpenArray Installation & Calibration Kit	1 kit	4478601
QuantStudio 12K Flex OpenArray RNase P Kit with Accessories Kit	1 kit	4469602
Accessories		
OpenArray AccuFill System Tips	Box of 384	4457246
OpenArray 384-Well Sample Plates	10 plates	4406947
OpenArray 384-Well Sample Plates, Barcoded	10 plates	4453929
TaqMan OpenArray Real-Time PCR Master Mix	5 mL	4462164
TaqMan OpenArray Real-Time PCR Master Mix	1.5 mL	4462159
TaqMan OpenArray Genotyping Master Mix	1 x 5 mL for 10 arrays	4404846
QuantStudio 12K Flex TaqMan OpenArray Accessories Kit	1 kit for 10 arrays	4469576
QuantStudio 12K Flex TaqMan OpenArray Genotyping Training Plate (requires QuantStudio 12K Flex TaqMan OpenArray Accessories Kit, Cat. No. 4469576, available separately)	Sold as single plates	4471225
QuantStudio 12K Flex TaqMan OpenArray HS Endogenous Control Panel (requires QuantStudio 12K Flex TaqMan OpenArray Accessories Kit, Cat. No. 4469576, available separately)	Sold as single plates	4471226
Service		
AB Assurance, QuantStudio 12K Flex system with OpenArray block		ZG11SCQ STUDIO 12K-OA
AB Assurance, AccuFill System		ZG11SC ACCUFILL
Block upgrades		
96-Well (Standard or Fast) Block Upgrade	1 standard block	4453543
	1 Fast block	4453544
384-Well Block Upgrade	1 block	4453545
QuantStudio 12K Flex TaqMan Array Card Block	1 block	4453546

QuantStudio 12K Flex TaqMan OpenArray plates

Product	Description
QuantStudio 12K Flex TaqMan OpenArray Genotyping kits	Available in 6 different plate formats with your choice of TaqMan SNP Genotyping, Custom TaqMan SNP Genotyping, or TaqMan Drug Metabolism Genotyping (DME) Assays. Each kit includes 10 QuantStudio 12K Flex TaqMan OpenArray Plates and one QuantStudio 12K Flex TaqMan OpenArray Accessories Kit.
QuantStudio 12K Flex TaqMan OpenArray Real-Time PCR kits	Available in 5 different plate formats of TaqMan Assays. Each TaqMan OpenArray Real-Time PCR Kit includes 10 QuantStudio 12K Flex TaqMan OpenArray Real-Time PCR Plates and one QuantStudio 12K Flex TaqMan OpenArray Accessories Kit.
QuantStudio 12K Flex TaqMan OpenArray Digital PCR plates	Available in two sizes for use with your TaqMan Assays. The 10-pack kit includes 10 QuantStudio 12K Flex TaqMan OpenArray Digital PCR Plates, TaqMan OpenArray Digital PCR Master Mix, and one QuantStudio 12K Flex TaqMan OpenArray Accessories Kit. The 4-pack kit includes 4 QuantStudio 12K Flex TaqMan OpenArray Digital PCR Plates and TaqMan OpenArray Digital PCR Master Mix. The QuantStudio 12K Flex TaqMan OpenArray Accessories Kit (Cat. No. 4469576) is required, but is not included with the 4-pack kit, and must be purchased separately.
QuantStudio 12K Flex TaqMan OpenArray MicroRNA Panels (human and rodent)	Single QuantStudio 12K Flex OpenArray plates for human or rodent (mouse and rat) miRNA profiling.
QuantStudio 12K Flex TaqMan OpenArray fixed-content panels	Single QuantStudio 12K Flex OpenArray plates for a specific biological process, pathway, or disease state. Panels include: cancer, genetic barcoding, stem cell, kinome, signal transduction, inflammation, and pharmacogenomics.
QuantStudio 12K Flex TaqMan OpenArray flexible-content panels	Single QuantStudio 12K Flex OpenArray plates in a preconfigured, but editable layout, for a pathway, disease, or research focus area. Panels are available for an expanding list of gene expression and genotyping applications.

Find out more at thermofisher.com/openarray