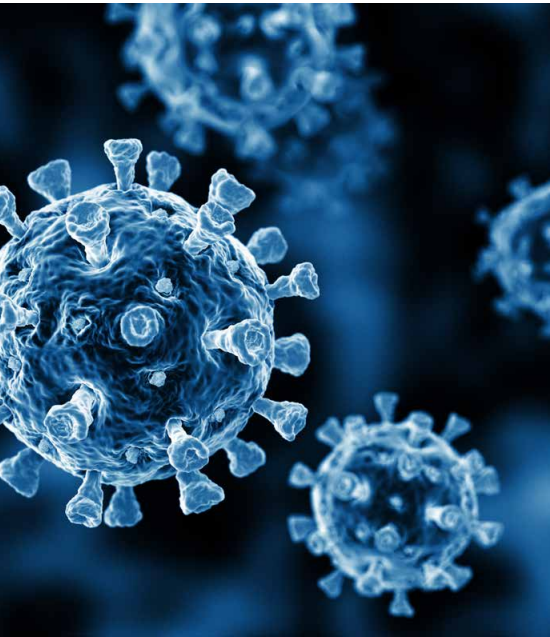


Advancing your SARS-CoV-2 research

TaqMan qPCR solutions for studying the biology and pathogenesis of SARS-CoV-2

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End-to-end qPCR solutions for pathogen biology research

SARS-CoV-2 is a novel virus in humans, and there are many unknowns about the viral lifecycle and pathogenesis. Studying pathogen biology and virus–host interactions is critical to understanding molecular pathogenesis, identifying relevant biomarkers, and developing future antiviral therapeutics.

Thermo Fisher Scientific offers qPCR solutions specifically designed for infectious disease research, including a robust library of pre-designed Applied Biosystems™ TaqMan® Gene Expression Assays targeting specific genes, pathways, and disease sets. TaqMan Assays contain everything you need, including Applied Biosystems™ TaqMan® MGB probe and PCR primer sets pre-mixed and formulated to work right out of the box. No additional design, optimization, or melt curve analysis is needed. Advanced primer/probe sequence selection criteria plus MGB probe enhancement deliver the specificity and reproducibility you need to help ensure confidence that your results are generated from target amplification—not non-specific dye binding. For optimal results, complement TaqMan Assays with application-specific Applied Biosystems™ TaqMan® master mixes.

Simplify your workflow with Applied Biosystems™ TaqMan® flexible array panels

Looking at a large set of genes in a pathway, disease, or biological process is an efficient way to identify markers of interest. Our flexible-content panels offer an easy way to select a relevant combination of assays in the format that matches your experiment. We have designed several flexible panels specifically for SARS-CoV-2 research that address the most cited genes related to entry and restriction factors as well as cytokines, chemokines, and growth factors. Each panel starts with a curated list of pre-designed TaqMan Gene Expression Assays preloaded into our easy-to-use online configurator, which allows you to modify the panel as needed to meet your research requirements. Easily add or delete assays, modify the layout, or change the selected controls. Flexible panels save time and effort by giving you the versatility and control of a custom-designed panel without the need to identify the appropriate assays from scratch.

Choose the format that best suits your experimental needs:

Single-tube assays in a variety of sizes



96-well plates:

- 0.2 mL
- 0.1 mL



384-well plates*

* Flexible panels are available in 384-well plates through our Specialty Plating service.

384-well
Applied Biosystems™
Custom TaqMan®
Array Cards



High-throughput
Applied Biosystems™
OpenArray™ technology



Viral entry factors

SARS-CoV-2 manipulates host factors to enable each phase of its life cycle, including viral entry. Elucidating the molecules and signaling pathways implicated in SARS-CoV-2 entry is key to understanding infectivity and tissue-specific tropism, pathogenesis, and immune evasion. As an essential step in the SARS-CoV-2 life cycle, viral entry is also a prime target for potential therapeutic intervention.

Coronavirus entry requires specific binding of the spike (S) protein to cellular entry receptors, followed by cleavage of the S protein by host proteases. While both SARS-CoV and SARS-CoV-2 use angiotensin-converting enzyme 2 (ACE2) as a receptor [1,2], virus-specific interactions with host cofactors are a critical determinant in viral entry, infectivity, and tissue tropism. Researchers have identified a variety of cofactors that facilitate entry of SARS-CoV-2 [1,3], including cell-surface serine proteases TMPRSS2 and TMPRSS4 [4], and neuropilin-1 (NRP1) [5]. RNA expression analysis demonstrates that these host cofactors are differentially expressed in human tissues [3], indicating flexibility and redundancy in cofactor utilization. Further research into viral entry is needed to understand differential infectivity of viral variants, elucidate the molecular mechanisms of tissue-specific pathology, and identify potential therapeutic targets.

The **Applied Biosystems™ TaqMan® Coronavirus Entry Factor Flexible Array Panel** targets 13 genes involved in the attachment of SARS-CoV-2 and other associated coronaviruses to the host cells. The panel also contains three positions for additional targets of interest and/or candidate endogenous controls.

Current endogenous controls, PPIA and GAPDH, were chosen due to their stable expression levels [6].

Available for multiple species (human, mouse, or rat), and in these formats: 96-well plates (0.1 and 0.2 mL), TaqMan Array Cards, and OpenArray technology.

Target genes:

ACE2, TMPRSS2, TMPRSS4, TMPRSS11A, TMPRSS11B, BSG, ANPEP, CLEC4G, FURIN, CTSL, CTSB, DPP4, NRP1

Controls:

- PPIA, GAPDH
- SDHA: optional control, not included on panel
- 18S: standard as manufacturing control

TaqMan Coronavirus Entry Factor Flexible Array Panel

Platform	Configuration	Cat. No.	Array ID	Species
TaqMan Array Card	16	4346798	RTZTEGZ	Human
TaqMan Array Plate, 96-well, 0.2 mL	16	4413264	RAH49YX	Human
TaqMan Array Plate, 96-well, 0.1 mL	16	4413261	RPFVKWR	Human
OpenArray technology	18	4471124	RVDJZJC	Human
TaqMan Array Card	16	4346798	RT2W72X	Mouse
TaqMan Array Plate, 96-well, 0.2 mL	16	4413264	RAMFW4T	Mouse
TaqMan Array Plate, 96-well, 0.1 mL	16	4413261	RPGZFGN	Mouse
OpenArray technology	18	4471124	RVEPR39	Mouse
TaqMan Array Card	16	4346798	RT322MV	Rat
TaqMan Array Plate, 96-well, 0.2 mL	16	4413264	RANKRPP	Rat
TaqMan Array Plate, 96-well, 0.1 mL	16	4413261	RPH492K	Rat
OpenArray technology	18	4471124	RVFVKN6	Rat

Viral restriction factors

Restriction factors are antiviral effector molecules produced by the host cell to inhibit early viral replication and propagation. Expression of host restriction factors can be induced via interferons (IFNs), important mediators in innate immune response. SARS-CoV-2 is shown to be inhibited by Type I IFNs [7,8], suggesting that interferon-stimulated genes (ISGs) and host restriction factors play an important role in antiviral defense [9].

Researchers have identified various ISGs that show broad antiviral activities against SARS-CoV-2, including restricting virus entry, inhibiting viral RNA synthesis, and blocking viral translation [10]. For example, the ISGs cholesterol 25-hydroxylase (CH25H) and lymphocyte antigen 6 complex, locus E (LY6E) both potentially restrict cellular infection by interfering with membrane fusion and viral entry [11,12]. Zinc finger antiviral protein (ZAP), which specifically targets CpG 5 dinucleotides in viral RNA sequences, is also shown to restrict SARS-CoV-2 [13]. Ultimately, a comprehensive analysis is required to identify the molecular effectors of SARS-CoV-2 inhibition and the molecular mechanisms that contribute to variable pathogenesis.

The **Applied Biosystems™ TaqMan® Coronavirus Restriction Factor Flexible Array Panel** targets 13 genes shown to interfere with various steps involved in the life cycle of SARS-CoV-2 and other associated coronaviruses. The panel also contains three positions for additional targets of interest and/or candidate endogenous controls.

Current endogenous controls, PPIA and GAPDH, were chosen due to their stable expression levels [6].

Available for multiple species (human, mouse, or rat), and in these formats: 96-well plates (0.1 and 0.2 mL), TaqMan Array Cards, and OpenArray technology.

Target genes:

LY6E, IFITM1, IFITM2, IFITM3, ZAP/ZC3HAV1, BST2, CLEC4D, ELF1, REC8, IFIT3, DNAJC6, ZBP1, CH25H

Controls:

- PPIA, GAPDH
- SDHA: optional control, not included on panel
- 18S: standard as manufacturing control

TaqMan Coronavirus Restriction Factor Flexible Array Panel

Platform	Configuration	Cat. No.	Array ID	Species
TaqMan Array Card	16	4346798	RTRWE2U	Human
TaqMan Array Plate, 96-well, 0.2 mL	16	4413264	RAWCWKF	Human
TaqMan Array Plate, 96-well, 0.1 mL	16	4413261	RTTZ9MR	Human
OpenArray technology	18	4471124	RVAAA EH	Human
TaqMan Array Card	16	4346798	RTTZ9MR	Mouse
TaqMan Array Plate, 96-well, 0.2 mL	16	4413264	RAXGP6D	Mouse
TaqMan Array Plate, 96-well, 0.1 mL	16	4413261	RPMFW7N	Mouse
OpenArray technology	18	4471124	RVCE3YF	Mouse
TaqMan Array Card	16	4346798	RTFVK2F	Rat
TaqMan Array Plate, 96-well, 0.2 mL	16	4413264	RAPRKAU	Rat
TaqMan Array Plate, 96-well, 0.1 mL	16	4413261	RA9HH6V	Rat
OpenArray technology	18	4471124	RVH49U2	Rat

Cytokines, chemokines, and growth factors

Cytokines, chemokines, and growth factors are signaling molecules that regulate host immune responses. Identifying the molecular mechanisms of different immune responses is critical to understanding host susceptibility and SARS-CoV-2 pathogenesis [9–12].

In response to SARS-CoV-2, a variety of immune pathways involved in inflammation, oxidative stress, and antiviral T cell responses are dysregulated. In severe cases of coronavirus, a proinflammatory cytokine storm, including IL-1, IL-6, IL-12, IFN- γ , and TNF- α , is an indicator of poor prognosis [14–16]. There is evidence that SARS-CoV-2 also perpetuates hyperinflammation via suppression of the antioxidant NRF2 gene expression pathway [17]. While a robust T cell response is required to control early immune responses, dysregulated T cell activation has negative associations [18]. Understanding the immune signaling pathways involved in SARS-CoV-2 will elucidate the beneficial and detrimental effects of the host immune response and guide future research for potential biomarkers and therapeutics.

The **Applied Biosystems™ TaqMan® Coronavirus Immune Signaling Flexible Array Panel** targets a portfolio of 29 cytokines, chemokines, and growth factors involved in the immune response to SARS-CoV-2 and other coronaviruses. The panel also contains three positions for additional targets of interest and/or candidate endogenous controls.

Current endogenous controls, PPIA and GAPDH, were chosen due to their stable expression levels [6].

Available for multiple species (human, mouse or rat), and in these formats: 96-well plates (0.1 and 0.2 mL), TaqMan Array Cards, and OpenArray technology.

Target genes:

IL1B, IL2, IL4, IL5, IL6, IL7, IL10, IL12, IL13, IL16, IL18, IFNB1, IFNg, TNF, TGFB1, M-CSF/CSF1R, MIF, VEGF, SCGF, HGF, TRAIL/TNFSF10, CCL2, CCL3/MIP1a, CCL5, CCL11, CCL27, CXCL1, CXCL10, CXCL12

Controls:

- PPIA, GAPDH
- SDHA: optional control, not included on panel
- 18S: standard as manufacturing control

TaqMan Coronavirus Immune Signaling Flexible Array Panel

Platform	Configuration	Cat. No.	Array ID	Species
TaqMan Array Card	32	4346799	RTYMJXF	Human
TaqMan Array Plate, 96-well, 0.2 mL	32	4391528	RA322F2	Human
TaqMan Array Plate, 96-well, 0.1 mL	32	4413259	RPRWEXF	Human
OpenArray technology	56	4471125	RVDJXJD	Human
TaqMan Array Card	32	4346799	RTCE4CM	Mouse
TaqMan Array Plate, 96-well, 0.2 mL	32	4391528	RA9HH6U	Mouse
TaqMan Array Plate, 96-well, 0.1 mL	32	4413259	RPWCWM7	Mouse
OpenArray technology	56	4471125	RVEPR4A	Mouse
TaqMan Array Card	32	4346799	RTDJXWJ	Rat
TaqMan Array Plate, 96-well, 0.2 mL	32	4391528	RAAAAJJ	Rat
TaqMan Array Plate, 96-well, 0.1 mL	32	4413259	RPXGP74	Rat
OpenArray technology	56	4471125	RVFVKN7	Rat

Targeting individual genes

If you need to focus on just a few or even a single gene, we offer predesigned TaqMan Assays in a single-tube format. These are available for any of the gene targets included in the flexible array panels, plus pro-inflammatory and cytotoxic mediators.

Predesigned TaqMan Assays consist of a forward primer, one or more TaqMan probes, and a reverse primer premixed and optimized for the specific gene of interest. These assays provide the ability to obtain fast, reliable, and accurate results with off-the-shelf assay kits rather than laboriously designing and optimizing your own.

Want to do more than gene expression? Assay solutions include SNP genotyping, copy number variation, and miRNA applications as well. TaqMan Assays are designed using a robust probe/primer design pipeline and verified using up-to-date annotations and gold-standard TaqMan Assay chemistry. That is why predesigned assays are backed by our performance guarantee—promising they will work as described or we will credit or replace them.*



Viral entry factors	Restriction factors	Cytokines	Pro-inflammatory and cytotoxic mediators		Chemokines and receptors	Additional targets
ACE2	BST2	IL1B	GNLY	KLRD1	CCL2	HGF
ANPEP	CH25H	IL2	GZMA	M-CSF	CCL3	IFIT1
BSG	CLEC4D	IL4	GZMB	MIF	CCL5	IFNGR1
CLEC4G	DNAJC6	IL5	GZMK	PRF1	CCL11	IFNGR2
CTSB	ELF1	IL6	IFNB1	TGFB1	CCL20	IFT43
CTSL	IFIT3	IL7	IFNG	TGFB2	CCL27	ISG15
DPP4	IFITM1	IL8	KLRB1	TNF	CCR1	KRT4
FURIN	IFITM2	IL10	KLRC1	TNFSF10	CCR5	KRT7
NRP1	IFITM3	IL12	KLRC2		CXCL1	SCGF
TMPRSS11A	LY6E	IL13			CXCL10	STAT1
TMPRSS11B	REC8	IL16			CXCL12	VEGF
TMPRSS2	ZAP / ZC3HAV1	IL18			CXCL3	
TMPRSS4	ZBP1				CXCL9	

* Terms and conditions apply. See full details of the guarantee at [thermofisher.com/taqmanguarantee](https://www.thermofisher.com/taqmanguarantee).

Maximize performance and workflow efficiency

TaqMan chemistry provides industry-recognized gold-standard performance, so pairing TaqMan Assays with a TaqMan master mix ensures you bring the highest sensitivity, specificity, and reproducibility to your qPCR research. Choose the mix that's right for your experiment.



Applied Biosystems™ TaqMan® Fast Advanced Master Mix

- Optimized for TaqMan Gene Expression Assays
- <40 min run time
- Formulated for multiplexing
- 72-hour benchtop stability
- Compatible with a wide range of real-time PCR instruments

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Applied Biosystems™ TaqMan® Fast Virus 1-Step Master Mix

- 1-step formula supports qPCR cycling in <30 mins
- Tolerant of inhibitors
- High-throughput capability
- Single-tube, 4X formulation

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