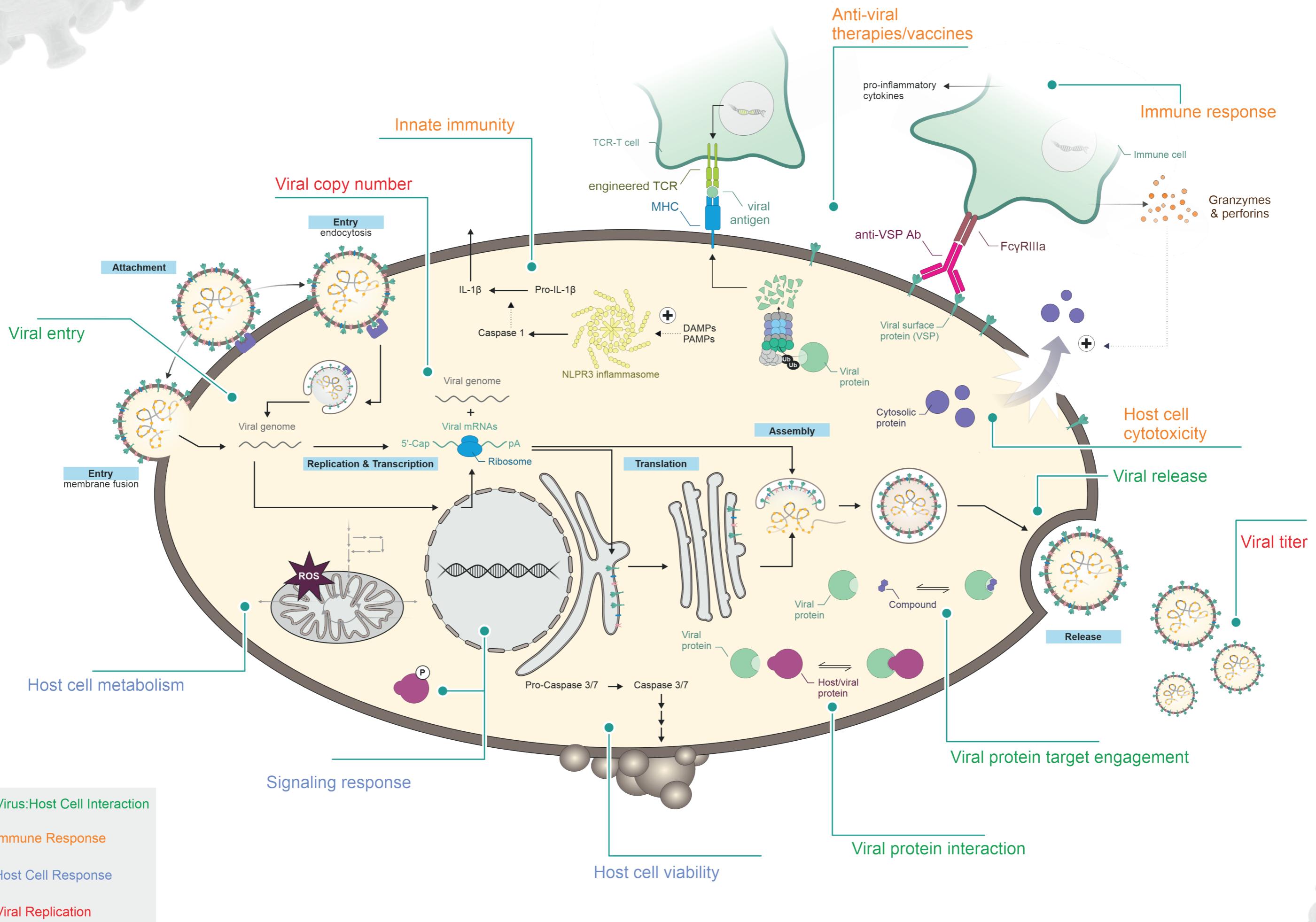


# Explore Your Options to Study Viral Infection

Virus:Host Cell Interaction | Immune Response |  
Host Cell Response | Viral Replication



## Virus:Host Cell Interaction

The interaction of viral and host cell proteins is fundamental for the viral replication cycle to proceed. It involves the interaction with proteins on the host cell surface that function as viral entry receptors as well as the various interactions taking place intracellularly upon viral entry. The development of drugs that inhibit the interaction of viral proteins among themselves as well as with host cell proteins is an important target for therapeutic intervention. In addition, vaccine effectiveness can be determined by examining the ability of serum to prevent cellular entry of the virus. NanoBiT® and NanoBRET™ are both bioluminescent technologies based on the NanoLuc® luciferase (Nluc) that enable live-cell analysis of protein interactions. Together with firefly luciferase (Fluc), NanoLuc® is utilized for the generation of reporter viruses and/or (pseudotyped) virus-like particles (VLP) to study viral entry and release. The versatile HiBiT Protein Tagging System allows for monitoring the dynamics of viral infection in real time. The small size of the HiBiT reporter tag (11 aa; 1.3 kDa) is particularly useful for viral studies as it can be easily integrated into small viral genomes.

## Immune Response

The host's immune reaction in response to viral infection is a key topic from basic research to drug/vaccine development. Promega offers a versatile toolbox of assays to investigate innate and adaptive immunity. NLRP3 inflammasome activation can be detected by measuring caspase-1 activity, the release of cytokines (e.g. IL-1- $\beta$ ), or damage-associated molecular patterns (DAMPs) (e.g. extracellular ATP and HMGB1). Novel therapeutic concepts are the activation and recruitment of immune cells by antibody-based drugs as well as the use of engineered T cells (TCR-T). Our vast portfolio of bioluminescent reporter assays supports the development of biologics at multiple levels. This includes mechanism of action (MOA) analysis as well as a wide selection of HiBiT target cells to selectively quantify target cell killing in a mixed population of cells. The potency of engineered T cell receptors to activate T cells can be reliably determined using TCR $\alpha$ -KO cells without the constraints of endogenous TCR expression.

## Host Cell Response

The infection by a virus can lead to a multitude of different responses of the host cell. These range from changes in gene expression, signaling, and metabolism to cytopathic effects that alter cell health. These virus-induced changes can be understood using reporter assays as well as assays monitoring nutrient uptake/consumption and changes in co-factor levels. Screening compounds for antiviral activity includes testing for viral-induced cytopathic effects (CPE) in host cells. Cell-based viability and cytotoxicity assays like CellTiter-Glo® Cell Viability Assay or Caspase-Glo® 3/7 Assay are amenable to high-throughput analysis, thereby reducing the time needed to analyze the effect of potential treatments. Viability and cytotoxicity assays can also be used to support studies investigating the mechanism of action of viruses.

## Viral Replication

We offer end-to-end solutions for scalable viral detection and sequence analysis, which are amenable for most sample types, from bodily fluids for research and diagnostics to wastewater samples for epidemiology. Our PCR-based methods (qPCR, RT-PCR, qRT-PCR with GoTaq® and GoScript™ technology) are fundamental tools used in the development of viral detection tests, and for analysis of viral genomes. Maxwell® instruments for automated medium scale extraction of nucleic acids as well as Spectrum Compact CE, an affordable benchtop instrument for Sanger sequencing and fragment analysis, are perfectly suited to study viral variants.

## Virus:Host Cell Interaction

### Viral entry

Quantify viral entry using luciferase-based reporter viruses or virus-like particles (VLP). Benefit from the ability of HiBiT to support measurements of the infection process in real-time.

Product	Cat. #	Quantity
<b>Firefly (Fluc)</b>		
ONE-Glo® Luciferase Assay System	E6110	10 ml
Bright-Glo® Luciferase Assay System	E2610	10 ml
Steady-Glo® Luciferase Assay System	E2510	10 ml
<b>NanoLuc® (Nluc) &amp; HiBiT</b>		
Nano-Glo® Luciferase Assay System	N1110	10 ml
LgBiT Expression Vector [CMV / Hygro]	N2681	20 µg
Nano-Glo® Live Cell Assay System	N2011	100 assays (96-well)
SARS-CoV-2 HiBiT-PsVLP Assay	Please enquire	120 assays (96-well)

Receive your free HiBiT tag sequence at [www.promega.com/HibiT-Synthesis](http://www.promega.com/HibiT-Synthesis) and tag your viral protein of interest.

### For more information, please view the following references.

Hooper, K. (2018) Size does matter: NanoLuc® Technologies advance virology research.  
Hooper, K. (2020) Choices for measuring luciferase-tagged reporter pseudotyped viral particles in coronavirus research.

### Viral release

Quantify viral release of HiBiT-tagged viruses or sub-viral particles in the cell culture supernatant.

Product	Cat. #	Quantity
Nano-Glo® HiBiT Lytic Detection System	N3030	10 ml

Receive your free HiBiT tag sequence at [www.promega.com/HibiT-Synthesis](http://www.promega.com/HibiT-Synthesis) and tag your viral protein of interest.

### Viral protein target engagement

Build your own NanoBRET™ TE assay to determine drug:viral protein interactions within a live-host cell context by measuring competitive displacement of a fluorescent tracer from a viral protein-NanoLuc® fusion.

Product	Cat. #	Quantity
NanoBRET™ amine reactive dyes	Please enquire	5 mg
NanoLuc® Protein Fusion MCS Vectors	N1361, N1351	20 µg
Intracellular TE Nano-Glo® Substrate/Inhibitor	N2162	100 assays (96-well)

Seeking guidance to build your own NanoBRET™ TE Assay? Check out Robers, M.B. et al. 2019, *Methods Mol Biol.* 1888:45-71

### Viral protein interaction

Investigate the interaction of viral proteins as well as their interactions with proteins of the host cell using biochemical or live-cell assay formats.

Product	Cat. #	Quantity
Lumit™ SARS-CoV-2 Spike RBD:hACE2 Immunoassay	CS3163B01 *	200 assays (96-well)
NanoBRET™ PPI MCS Starter System	N1811	1 kit
NanoBRET™ Nano-Glo® Detection System	N1661	200 assays (96-well)
NanoBRET™ Nano-Glo® Kinetic Detection System	N2583	200 assays (96-well)
NanoBiT® PPI MCS Starter System	N2014	1 kit
Nano-Glo® Live Cell Assay System	N2011	100 assays (96-well)

Visit [www.promega.com/halotag-technology](http://www.promega.com/halotag-technology) and benefit from >11,000 HaloTag® human full-length ORF clones.

## Immune Response

### Innate immunity

Explore various aspects of innate immunity with bioluminescent assays, i.e. release of cellular markers, enzymatic activity, and drug:protein interactions.

Product	Cat. #	Quantity
RealTime-Glo™ Extracellular ATP Assay	GA5010	200 assays (96-well)
Caspase-Glo® 1 Inflammasome Assay	G9951	10 ml
Lumit™ HMGB1 Immunoassay	W6110	100 assays (96-well)
Lumit™ Human IL-1 $\beta$ Immunoassay	W6010	100 assays (96-well)
NanoBRET™ TE NLRP3 Assay	CS1810C523 *	1,000 assays (96-well)

### Immune response

Quantify cytokine release with these bioluminescent assays based on the NanoBiT® luciferase reporter. Binding of two anti-target antibodies, prelabeled either with the LgBiT and SmBiT subunits allows for fast and highly specific target detection through bioluminescent reporter complementation.

Product	Cat. #	Quantity
Lumit™ Human IL-2 Immunoassay	W6020	100 assays (96-well)
Lumit™ Human IL-4 Immunoassay	W6060	100 assays (96-well)
Lumit™ Human IL-6 Immunoassay	W6030	100 assays (96-well)
Lumit™ Human IL-10 Immunoassay	W6070	100 assays (96-well)
Lumit™ Human IFN- $\gamma$ Immunoassay	W6040	100 assays (96-well)
Lumit™ Human TNF- $\alpha$ Immunoassay	W6050	100 assays (96-well)

Looking for a different cytokine? Please enquire: [TailoredSolutions@promega.com](mailto:TailoredSolutions@promega.com)

### Anti-viral therapies/vaccines

Confirm the mechanism of action (MOA) of (therapeutic) antibodies, e.g. antibody-dependent cell-mediated cytotoxicity (ADCC), check for the presence of antiviral antibodies in serum. Measure the potency of engineered T cell receptors to activate T cells without the constraints of endogenous TCR expression.

Product	Cat. #	Quantity
ADCC Reporter Bioassay, Complete Kit (Raji)	G7015	1 kit; 120 assays (96-well)
SARS-CoV-2-S CHO-K1 <sup>1</sup>	CS3195A05 *	1 vial
RiboMAX™ Large Scale RNA Production Systems T7	P1300	1 kit
T Cell Activation Bioassay (TCR $\alpha$ $\beta$ -KO, CD4+), Propagation Model <sup>2</sup>	GA1172	2 vials
T Cell Activation Bioassay (TCR $\alpha$ $\beta$ -KO, CD8+), Propagation Model <sup>2</sup>	GA1162	2 vials
T Cell Activation Bioassay (TCR $\alpha$ $\beta$ -KO, CD4+, CD8+), Propagation Model <sup>2</sup>	GA1182	2 vials

<sup>1</sup> can be used as target cells in the ADCC Reporter Bioassay

<sup>2</sup> TCR $\alpha$  $\beta$ -KO cell lines expressing defined viral antigen specificity (e.g. JG-9, InflA-M1, HPV-E6, HPV-E7, HA1.7, HPV16 E7) are available as Early Access material. Please enquire.

### Host cell cytotoxicity

Determine target cell killing by immune cells and confirm the mechanism of action (MOA), e.g. antibody-dependent cell-mediated cytotoxicity (ADCC).

Product	Cat. #	Quantity
PBMC ADCC Bioassay Kit (Raji)	CS3055A14 *	1 kit; 120 assays (96-well)
Human PBMC, ADCC Qualified	CS3055A01 *	1 vial
SARS-CoV-2-S CHO-K1 (Halo-Tag®-HiBiT) <sup>3</sup>	CS3195A01 *	1 vial

<sup>3</sup> can be used as target cells in the PBMC ADCC Bioassay

## Host Cell Response

Host cell metabolism		
Reliably quantify various markers of cellular metabolism with bioluminescent add-mix-measure assays.		
Product	Cat. #	Quantity
NAD(P)H-Glo™ Detection System	G9061	10 ml
Glucose-Glo™ Assay	J6021	5 ml
Lactate-Glo™ Assay	J5021	5 ml
Glutamine/Glutamate-Glo™ Assay	J8021	5 ml
ROS-Glo™ H <sub>2</sub> O <sub>2</sub> Assay	G8820	10 ml
GSH/GSSG-Glo™ Assay	V6611	10 ml

Signaling response		
Study changes in host cell signaling upon viral infection on the transcriptional level with Rapid Response™ luciferase gene reporter vectors or determine post-translational modifications directly from cell lysates within hours.		
Product	Cat. #	Quantity
Transcriptional level		
pGL4.32[Luc2P/NF-κB RE/Hygro] Vector	E8491	20 µg
pNL3.2.NF-κB-RE [NLucP/NF-κB RE/Hygro] Vector	N1111	20 µg
pGL4.37[Luc2P/ARE/Hygro] Vector	E3641	20 µg
pGL4.39[Luc2P/ATF6 RE/Hygro] Vector	E3661	20 µg
pGL4.42[Luc2P/HRE/Hygro] Vector	E4001	20 µg
pGL4.45[Luc2P/ISRE/Hygro]	E4141	20 µg

Please visit <a href="http://www.promega.com">www.promega.com</a> to view our large selection of ready-to-use reporter vectors.		
Nano-Glo® Luciferase Assay System	N1110	10 ml
Nano-Glo® Dual Luciferase Reporter Assay System	N1610	10 ml
ONE-Glo® Luciferase Assay System	E6110	10 ml
Dual-Glo® Luciferase Assay System	E2920	10 ml
FuGENE® HD Transfection Reagent	E2311	1 ml
Post-translational level		
Lumit™ Immunoassay Cellular Systems – Starter Kit	W1220	200 assays (96-well)

Please visit [www.promega.com/LumitCellularSystems](http://www.promega.com/LumitCellularSystems) to view application notes for validated targets.

Host cell viability		
Monitor key markers of host cell viability with bioluminescent endpoint or real time assays.		
Product	Cat. #	Quantity
LDH-Glo™ Cytotoxicity Assay	J2380	10 ml
Caspase-Glo® 3/7 Assay	G8091	10 ml
RealTime-Glo™ Annexin V Apoptosis and Necrosis Assay	JA1011	100 assays (96-well)
CellTiter-Glo® Cell Viability Assay	G7570	10 ml
RealTime-Glo™ MT Cell Viability Assay	G9711	100 reactions
CellTiter-Fluor™ Cell Viability Assay	G6080	10 ml
CytoTox-Glo™ Cytotoxicity Assay	G9290	10 ml
CytoTox-Fluor™ Cytotoxicity Assay	G9260	10 ml

## Viral Replication

Viral copy number & Viral titer		
Choose from manual and automated solutions to isolate total viral nucleic acids from various sample types. Efficiently amplify viral DNA/RNA to assess viral copy number and conveniently determine viral titers in a plate-based bioluminescent assay.		
Product	Cat. #	Quantity
RNasin® Plus Ribonuclease Inhibitor	N2611	2,500 units
ReliaPrep™ Viral TNA Miniprep System, Custom	AX4820	250 preps
Maxwell® HT Viral TNA Kit, Custom	AX2340	4 x 96 preps
Maxwell® RSC Viral Total Nucleic Acid Purification Kit	AS1330	48 reactions
GoScript™ Reverse Transcription System	A5000	50 reactions
GoTaq® Probe qPCR System	A6101	2 ml
GoTaq® Probe 1 Step RT-qPCR System	A6120	2 ml
XpressAmp™ Direct Amplification Reagents	A8882	250 reactions
Viral ToxGlo™ Assay	G8941	10 ml
T7 RiboMAX™ Express Large Scale RNA Production System	P1320	1 system

Environment and wastewater		
GoTaq® Enviro Wastewater SARS-CoV-2 System, N1		
GoTaq® Enviro Wastewater SARS-CoV-2 System, N2	AM2120	200 reactions
GoTaq® Enviro Wastewater SARS-CoV-2 System, E	AM2130	200 reactions
GoTaq® Enviro PMMoV Quant Kit, Quasar® 670	AM2140	100 reactions
SARS-CoV-2 Variant Panel-8 Targets	CS3174B02 *	8 x 50 preps
GoTaq® Enviro Noro/HepA System	CS317420 *	100 reactions
GoTaq® Enviro FluA/FluB/SARS-CoV-2/RSV System	CS317421 *	100 reactions
GoTaq® Enviro FluA/FluB/SARS-CoV-2 System	CS317422 *	100 reactions
PMMoV RNA Quant Standard	AM2070	10 µl
GoTaq® Enviro qPCR Systems	AM2001	10 ml
GoTaq® Enviro RT-qPCR Systems	AM2011	200 reactions

\* This is an Early Access Material. Please enquire for more information.

## Instruments

Product	Cat. #	Quantity
Luminescence / Fluorescence / Absorbance		
GloMax® Discover System	GM3000	1
Automated Nucleic Acid Purification		
Maxwell® RSC Instrument	AS4500	1
Sanger Sequencing / Fragment Analysis		
Spectrum Compact CE System	CE1304	1

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