GeneQuery™ Human Cell Surface Markers qPCR Array Kit (GQH-CSM)
Catalog #GK126

Product Description
ScienCell's GeneQuery™ Human Cell Surface Markers qPCR Array Kit (GQH-CSM) surveys a panel of 88 cell surface markers. Cell surface markers are proteins attached to the cell membrane that may serve as markers for the identification and characterization of specific cell types. They have also been linked to transmembrane transport and inter-cellular communication. Brief examples of how genes may be grouped are shown below:

- **B-cell surface markers:** CD1C, CD28, CD79, CD80, CD86, CR1, FCGR2A, ITGA3, MS4A1, NT5E
- **T-cell surface markers:** CD4, CD8, CD3, CD6, CD40LG, CTLA4, FAS, TNFRSF4
- **Natural killer (NK) cell surface markers:** CD2, CD7, CD96, CD244, CD247, IL12RB1, KLRs, NCAM1
- **Macrophage and monocyte surface markers:** CD33, CD63, CD69, CD70, CD74, DPP4, IL1R2, ITGA1, TNFRSF8
- **Platelet surface markers:** ITGA2B, ITGB3, SELP
- **Dendritic cell surface markers:** CD1A, CD40, CD83, CD86, CD209, IL3RA, ITGAX
- **Granulocyte surface markers:** C5AR1, CEACAM8, FCER1A, FCER2, FCGR3A
- **Endothelial cell surface markers:** ENG, ICAM2, MCAM, NOS3, PECAM1, TEK, VCAM1, VWF
- **Epithelial cell surface markers:** CD1D, EPCAM, KRT8, KRT18
- **Smooth muscle cell surface markers:** MYH9, MYH10, MYOCD
- **Fibroblast surface markers:** ALCAM, COL1A1, COL1A2

<u>*Note*</u>**:** all gene names follow their official symbols by the Human Genome Organization Gene Nomenclature Committee (HGNC).

GeneQuery™ qPCR array kits are qPCR ready in a 96-well plate format, with each well containing one primer set that can specifically recognize and efficiently amplify a target gene's cDNA. The carefully designed primers ensure that: (i) the optimal annealing temperature in qPCR analysis is 65°C (with 2 mM Mg^{2+}, and no DMSO); (ii) the primer set recognizes all known transcript variants of target gene, unless otherwise indicated; and (iii) only one gene is amplified. Each primer set has been validated by qPCR with melt curve analysis, and gel electrophoresis.

GeneQuery™ qPCR Array Kit Controls
Each GeneQuery™ plate contains eight controls (Figure 1).
- Five target housekeeping genes (ACTB, GAPDH, LDHA, NONO, and PPIH), which enable normalization of data.

- The Genomic DNA (gDNA) Control (GDC) detects possible gDNA contamination in the cDNA samples. It contains a primer set targeting a non-transcribed region of the genome.
- Positive PCR Control (PPC) tests whether samples contain inhibitors or other factors that may negatively affect gene expression results. The PPC consists of a predispensed synthetic DNA template and a primer set that can amplify it. The sequence of the DNA template is not present in the human genome, and thus tests the efficiency of the polymerase chain reaction itself.
- The No Template Control (NTC) is strongly recommended, and can be used to monitor the DNA contamination introduced during the workflow such as reagents, tips, and the lab bench.

Kit Components

Component	Quantity	Storage
GeneQuery™ array plate with lyophilized primers	1	4°C or -20°C
Optical PCR plate seal	1	RT
Nuclease-free H_2O	2 mL	4°C

Additional Materials Required (Materials Not Included in Kit)

Component	Recommended
Reverse transcriptase	MultiScribe Reverse Transcriptase (Life Tech, Cat. #4311235)
cDNA template	Customers' samples
qPCR master mix	FastStart Essential DNA Green Master (Roche, Cat. #06402712001)

Quality Control
All the primer sets are validated by qPCR with melt curve analysis. The PCR products are analyzed by gel electrophoresis. Single band amplification is confirmed for each set of primers.

Product Use
GQH-CSM is for research use only. It is not approved for human or animal use, or for application in clinical or *in vitro* diagnostic procedures.

Shipping and Storage
The product is shipped at ambient temperature. Upon receipt, the plate should be stored at 4°C and is good for up to 12 months. For long-term storage (>1 year), store the plate at -20°C in a manual defrost freezer.

Procedures

Note: The primers in each well are lyophilized.

1. Prior to use, allow plates to warm to room temperature.
2. Briefly centrifuge at 1,500x g for 1 minute before slowly peeling off the seal.
3. Prepare 20 µl PCR reactions for one well as shown in Table 1.

Table 1

cDNA template	0.2 – 250 ng
2x qPCR master mix	10 µl
Nuclease-free H_2O	variable
Total volume	*20 µl*

*Important: **Only** use polymerases with hot-start capability to prevent possible primer-dimer formation. **Only** use nuclease-free reagents in PCR amplification.*

4. Add the mixture of 2x qPCR master mix, cDNA template, and nuclease-free H_2O to each well containing the lyophilized primers. Seal the plate with the provided optical PCR plate seal.

   Important: In NTC control well, do NOT add cDNA template. Add 2x qPCR master mix and nuclease-free H2O only.

5. Briefly centrifuge the plates at 1,500x g for 1 minute at room temperature. For maximum reliability, replicates are strongly recommended (minimum of 3).

6. For PCR program setup, please refer to the instructions of the master mix of the user's choice. We recommend a typical 3-step qPCR protocol for a 200nt amplicon:

Three-step cycling protocol

Step	Temperature	Time	Number of cycles
Initial denaturation	95°C	10 min	1
Denaturation	95°C	20 sec	
Annealing	65°C	20 sec	40
Extension	72°C	20 sec	
Data acquisition	Plate read		
Recommended	*Melting curve analysis*		1
Hold	4°C	Indefinite	1

7. (Optional) Load the PCR products on 1.5% agarose gel and perform electrophoresis to confirm the single band amplification in each well.

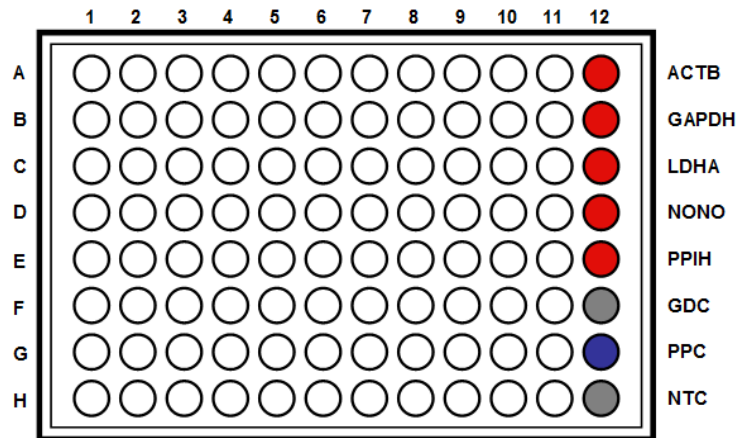Figure 1. Layout of GeneQuery™ qPCR array kit controls.

Table 2. Interpretation of control results:

Controls	Results	Interpretation	Suggestions
Housekeeping gene controls	Variability of a housekeeping gene's Cq value	The expression of the housekeeping gene is variable in samples; cycling program is incorrect	Choose a constantly expressed target, or analyze expression levels of multiple housekeeping genes; use correct cycling program and make sure that all cycle parameters have been correctly entered
gDNA Control (GDC)	$Cq \geq 35$	No gDNA detected	N/A
	$Cq < 35$	The sample is contaminated with gDNA	Perform DNase digestion during RNA purification step
Positive PCR Control (PPC)	$Cq > 30$; or The Cq variations > 2 between qPCR Arrays.	Poor PCR performance; possible PCR inhibitor in reactions; cycling program incorrect	Eliminate inhibitor by purifying samples; use correct cycling program and make sure that all cycle parameters have been correctly entered
No Template Control (NTC)	Positive	DNA contamination in workflow	Eliminate sources of DNA contamination (reagents, plastics, etc.)

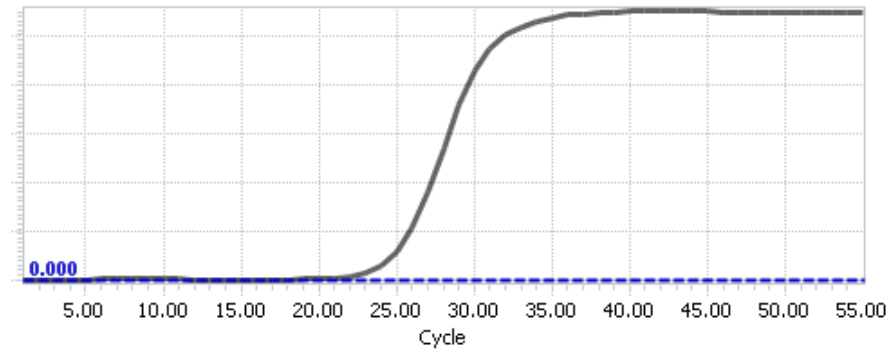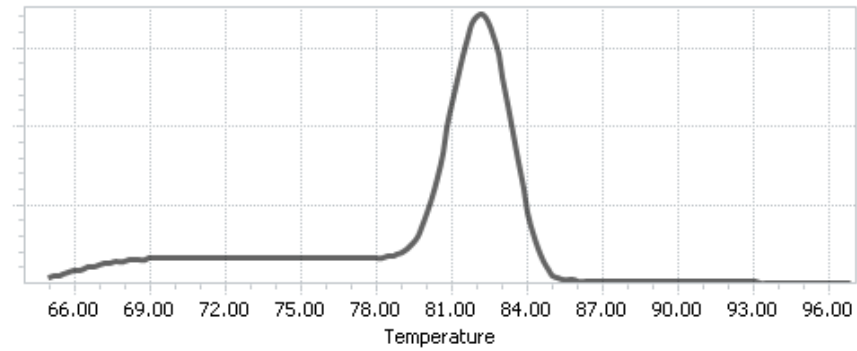Figure 2. A typical amplification curve showing the amplification of a qPCR product.

Figure 3. A typical melting peak of a qPCR product.

Quantification Method: Comparative ΔΔCq (Quantification Cycle Value) Method

1. **Note:** Please refer to your qPCR instrument's data analysis software for data analysis. The method provided here serves as guidance for quick manual calculations.

   You can use one or more housekeeping genes as a reference to normalize samples.

   Important: We highly recommend using all 5 housekeeping genes included in this kit, β-actin, GAPDH, LDHA, NONO, and PPIH.

2. For a single housekeeping gene, ΔCq (ref) is the quantification cycle number change for that housekeeping gene (HKG) between an experimental sample and control sample.

   ΔCq (ref) = Cq (HKG, experimental sample) - Cq (HKG, control sample)

   When using multiple housekeeping genes as a reference, we recommend normalizing using the geometric mean [1] of the expression level change, which is the same as normalizing using the arithmetic mean of ΔCq of the selected housekeeping genes.

   ΔCq (ref) = average (ΔCq (HKG1), ΔCq (HKG2),......., ΔCq (HKG n)) (n is the number of housekeeping genes selected)

   If using all 5 housekeeping genes included in this kit, β-actin, GAPDH, LDHA, NONO, and PPIH, use the following formula:

   ΔCq (ref) = (ΔCq(β-actin)+ΔCq(GAPDH)+ΔCq(LDHA)+ΔCq(NONO)+ΔCq(PPIH)) /5

   Note: ΔCq (HKG) = Cq (HKG, experimental sample) - Cq (HKG, control sample), and ΔCq (HKG) value can be positive, 0, or negative.

3. For any of your genes of interest (GOI),

   ΔCq (GOI) = Cq (GOI, experimental sample) - Cq (GOI, control sample)

   ΔΔCq = ΔCq (GOI) - ΔCq (ref)

   Normalized GOI expression level fold change = $2^{-\Delta\Delta Cq}$

References

[1] Vandesompele J, De Preter K, Pattyn F, Poppe B, Van Roy N, De Paepe A, Speleman F. (2002) "Accurate normalization of real-time quantitative RT-PCR data by geometric averaging of multiple internal control genes." *Genome Biol.* 3(7): 1-12.

Example: Comparative ΔΔCq (Quantification Cycle Value) Method

Table 3. Cq (Quantification Cycle) values of 2 genes-of-interest and 5 housekeeping genes obtained for experimental and control samples.

Samples	Genes of Interest		Housekeeping Genes				
	GOI1	GOI2	β-actin	GAPDH	LDHA	NONO	PPIH
Experimental	21.61	22.19	17.16	17.84	20.12	19.64	26.40
Control	33.13	26.47	18.20	18.48	20.57	19.50	26.55

ΔCq (ref) = (ΔCq(β-actin)+ΔCq(GAPDH)+ΔCq(LDHA)+ΔCq(NONO)+ΔCq(PPIH)) /5

      = ((17.16-18.20)+(17.84-18.48)+(20.12-20.57)+(19.64-19.50)+(26.40-26.55))/5

      = -0.43

ΔCq (GOI1) = 21.61 - 33.13

      = -11.52

ΔCq (GOI2) = 22.19 - 26.47

      = -4.28

ΔΔCq (GOI1) = ΔCq (GOI1) - ΔCq (ref)

      = -11.52 - (-0.43)

      = -11.09

ΔΔCq (GOI2) = ΔCq (GOI2) - ΔCq (ref)

      = -4.28 - (-0.43)

      = -3.85

Normalized GOI1 expression level fold change $= 2^{-\Delta\Delta Cq\,(GOI1)}$

$$= 2^{11.09}$$
$$= 2180$$

Normalized GOI2 expression level fold change $= 2^{-\Delta\Delta Cq\,(GOI2)}$

$$= 2^{3.85}$$
$$= 14.4$$

Conclusion: Upon treatment, expression level of GOI1 increased 2,180 fold, and expression level of GOI2 increased 14.4 fold.

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GeneQuery™ Human Cell Surface Markers qPCR Array Plate Layout*
(**8 controls** in Bold and Italic)

Note: all gene names follow their official symbols by HGNC

	1	2	3	4	5	6	7	8	9	10	11	12
A	ALCAM	CD2	CD37	CD6	CD79B	COL1A1	EPCAM	HLA-DRA	ITGA2B	KRT8	NT5E	*ACTB*
B	C5AR1	CD209	CD38	CD63	CD80	COL1A2	FAS	ICAM2	ITGA3	MCAM	PECAM1	*GAPDH*
C	CD160	CD22	CD3D	CD69	CD83	CR1	FCER1A	IL12RB1	ITGAX	MS4A1	SELP	*LDHA*
D	CD163	CD24	CD3G	CD7	CD86	CR2	FCER2	IL1R2	ITGB3	MYH10	TEK	*NONO*
E	CD19	CD244	CD4	CD70	CD8A	CSF1R	FCGR1A	IL2RA	KLRB1	MYH9	TNFRSF4	*PPIH*
F	CD1A	CD247	CD40	CD72	CD8B	CTLA4	FCGR2A	IL3RA	KLRC1	MYOCD	TNFRSF8	*GDC*
G	CD1C	CD28	CD40LG	CD74	CD96	DPP4	FCGR3A	ITGA1	KLRD1	NCAM1	VCAM1	*PPC*
H	CD1D	CD33	CD5	CD79A	CEACAM8	ENG	HLA-A	ITGA2	KRT18	NOS3	VWF	*NTC*

* gene selection may be updated based on new research and development

Appendix. Plate type choice chart.

Plate type A

Brand	Model	kit catalog #
ABI / Life Tech	ABI 5700	GK126-A
	ABI 7000	GK126-A
	ABI 7300	GK126-A
	ABI 7500	GK126-A
	ABI 7700	GK126-A
	ABI 7900 HT	GK126-A
	QuantStudio	GK126-A
	ViiA 7	GK126-A
Bio-Rad	Chromo4	GK126-A
	iCycler	GK126-A
	iQ5	GK126-A
	MyiQ	GK126-A
	MyiQ2	GK126-A
Eppendorf / Life Tech	Matercycler ep realplex 2	GK126-A
	Matercycler ep realplex 4	GK126-A
Stratagene	MX3000P	GK126-A
	MX3005P	GK126-A

Plate type B

Brand	Model	kit catalog #
ABI / Life Tech	ABI 7500 Fast	GK126-B
	ABI 7900 HT Fast	GK126-B
	QuantStudio Fast	GK126-B
	StepOnePlus	GK126-B
	ViiA 7 Fast	GK126-B
Bio-Rad	CFX Connect	GK126-B
	CFX96	GK126-B
	DNA Engine Opticon 2	GK126-B
Stratagene	MX4000	GK126-B

Plate type C

Brand	Model	kit catalog #
Roche	Lightcycler 96	GK126-C
	Lightcycler 480 (96-well)	GK126-C