



# Hairpin-it<sup>TM</sup> miRNAs qPCR Quantitation Kit

For the detection and quantification of  
microRNAs using real-time PCR detection  
instruments.

Catalog No. QPM-010/ QPM-011/ QPM-012/ QPM-013

User Manual

# Table of Contents

Kit Contents and Storage .....	1
Accessory Products .....	1
<b>Introduction .....</b>	<b>2</b>
Overview .....	2
Components of the Kit .....	4
<b>Methods .....</b>	<b>6</b>
Introduction .....	6
Handling the synthetic microRNA standard .....	6
Handling the microRNA RT primer .....	6
Preparing The RT Reaction Mix.....	7
Performing miRNAs RT Reaction.....	7
Handling the microRNA RT product.....	8
Preparing Real-Time Reaction Mix.....	8
Performing miRNAs Real-time PCR Reaction.....	8
ROX Reference Dye .....	8
Construction a standard curve .....	9
<b>Appendix .....</b>	<b>10</b>
Technical Service .....	10

## Kit Contents and Storage

Cat. No. QPM-010	Size: 100rxns
Cat. No. QPM-011	Size: 200 rxns
Cat. No. QPM-012	Size: 300 rxns
Cat. No. QPM-013	Size: 500 rxns

### Hairpin-it™ miRNAs qPCR Quantitation Kit Reagents

Hairpin-it™ miRNAs qPCR Quantitation Kit Reagents box includes the following items. Store the components at  $-20^{\circ}\text{C}$ . **Reagents must be stored in the dark.**

Reagent	Amount			Storage
	100rxns	200rxns	500 rxns	
Real-time PCR Master Mix ( $5\times$ ) *	1.0 ml	$2\times 1.0$ ml	$5\times 1.0$ ml	$4^{\circ}\text{C}$
miRNA specific primer Set ( $10\mu\text{M}$ )	$100\mu\text{l}$	$200\mu\text{l}$	1.0 ml	$-20^{\circ}\text{C}$
miRNA RT primer ( $10\mu\text{M}$ )	$15\mu\text{l}$	$50\mu\text{l}$	$100\mu\text{l}$	$-20^{\circ}\text{C}$
Taq DNA polymerase ( $5\text{U}/\mu\text{l}$ )	$50\mu\text{l}$	$100\mu\text{l}$	$200\mu\text{l}$	$-20^{\circ}\text{C}$
Synthetic miRNA Standard	1nmol			$-20^{\circ}\text{C}$
1X RNA Dilution buffer	$2\times 1.0$ ml	$4\times 1.0$ ml	$10\times 1.0$ ml	$4^{\circ}\text{C}$

\*Include dNTP Mixture,  $\text{Mg}^{2+}$ , Molecular Beacon probe.

## Accessory Products

### Accessory Products

Some of the reagents supplied in the Hairpin-it™ miRNAs qPCR Quantitation Kit as well as other products suitable for use with the kit are available separately from Genepharm. Ordering information is provided below. For more information, refer to our Web site ([www.genepharm.com](http://www.genepharm.com)).

Item	Amount	Catalog no.
U6 snRNA qPCR Normalization Kit	20 rxns	QPM-090
	50 rxns	QPM-091
5S rRNA qPCR Normalization Kit	$25\mu\text{l}\times 50$ rxns	QPM-080
	$25\mu\text{l}\times 100$ rxns	QPM-081
miRNAs qPCR Quantitation Core Kit	100 rxns	QPM-030
	200 rxns	QPM-031
	500 rxns	QPM-032
Custom miRNAs Quantitation Kit	$40\mu\text{l}\times 50$ rxns	QPM-040
	$40\mu\text{l}\times 100$ rxns	QPM-041
	$40\mu\text{l}\times 200$ rxns	QPM-042

# Introduction

## Overview

### Introduction

The Hairpin-it™ miRNAs qPCR Quantitation Kit is a sensitive and specific method using real-time PCR for the detection and quantification of microRNAs (miRNA) from total RNA samples. MiRNAs are small, single-stranded, ~19–23 nt RNA molecules encoded in the genomes of plants, animals, and viruses. Mature miRNAs enter the RNA-induced silencing complex (RISC) and guide the RISC to induce translational repression or endonucleolytic cleavage of specific target mRNAs. Unlike commonly used methods for detection of miRNAs, the Hairpin-it™ miRNAs qPCR Quantitation Kit is more rapid and sensitive.

This Kit contains miRNA specific RT and PCR primer set, with a Molecular Beacon probe included. The stem-loop like miRNAs RT primer and the miRNAs specific Beacon probe ensure the RT and PCR reaction would not be interfered by the miRNAs precursors. The reaction template could be total RNA or cell lysates.

To normalize for RNA content among different experimental samples, the **U6 snRNA qPCR Normalization Kit** (Cat # QPM-050) and **5S rRNA qPCR Normalization Kit** (Cat # QPM-060) are available separately. For more information about these kits, see: [http:// www.genepharma.com](http://www.genepharma.com).

The system enables highly sensitive detection from as few as 10 copies of a target miRNAs, with a broad dynamic range that supports accurate quantification of high-copy mRNA from up to 1 µg of total RNA:

- **High specificity** ensured by stemloop RT primer and miRNAs molecular Beacon probe; even highly homologized miRNAs can be accurately discriminated.
- **Higher dynamic range and sensitivity** of miRNAs quantification than conventional method (such as Northern blot & micro-array) with broad dynamic range of at least seven orders of magnitude, and in this ready to use formulation can quantify as few as 7 copies of a miRNA target in as little as 0.1 pg of total RNA.
- **Less sample requirement** Total RNA, cell lysate or purified small RNA can work as the qPCR Quantitation Kit's template, even the genomic DNA contamination would not interfere in miRNAs quantification.
- **miRNA synthetic standard** can work as a standard curve when you need to know the absolute number of a miRNA in one cell or work as positive control when you need to know the relative expression ratio between miRNA and U6 snRNA or 5S rRNA..

*continued on next page*

**Schematic  
Description  
of  
Hairpin-it™  
miRNAs  
qPCR  
Quantitation  
Assay**

Hairpin-it™ miRNAs real-time Quantitation assay of miRNAs includes two steps, stem-loop RT and real-time PCR. Stem-loop RT primers bind to at the 3' portion of miRNA molecules and are reverse transcribed with reverse transcriptase. Then, the RT product is quantified using real-time PCR that includes miRNA-specific forward primer, reverse primer and a dye-labeled Molecular Beacon probes.

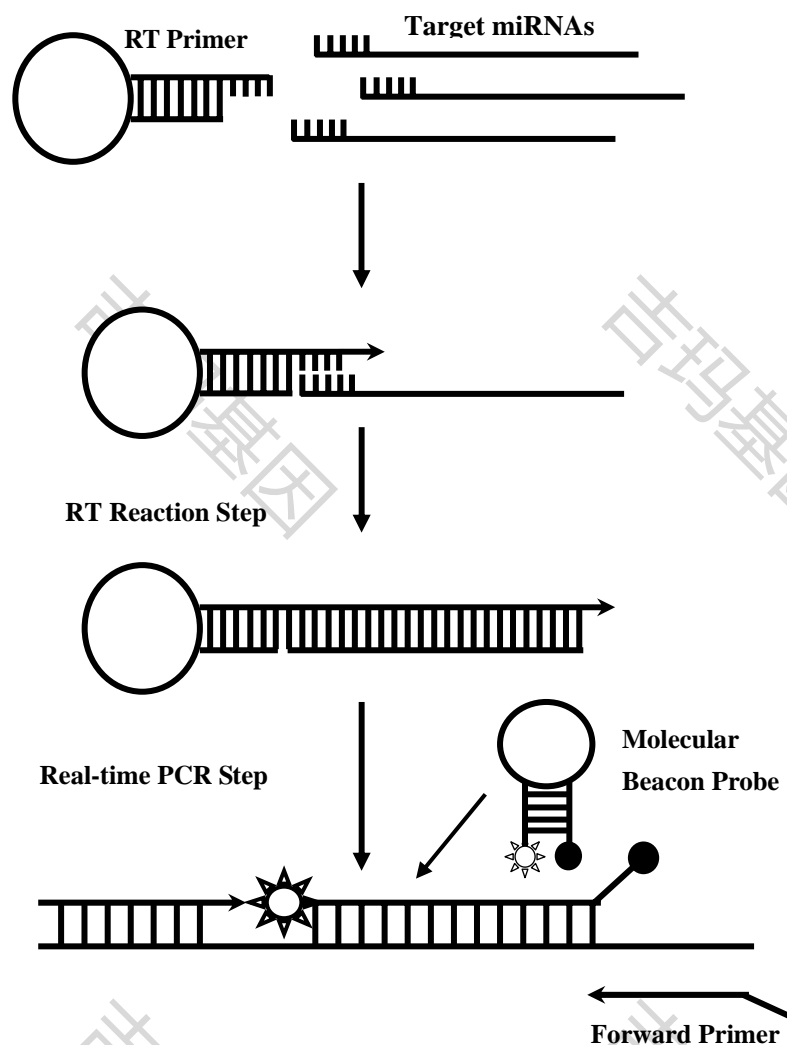


Fig 1. Schematic of Hairpin-it™ miRNAs real-time Quantitation assay

# Components of the Kit

---

## Introduction

This section provides more information about the reagents supplied in the Hairpin-it™ miRNAs qPCR Quantitation Kit.

---

## Real-time PCR Master Mix 5× Conc.

The 5× Real-time PCR Master Mix consists of a proprietary buffer system, MgCl<sub>2</sub>, dNTPs, and a miRNA specific Molecular Beacon probe. The mix includes 0.2 mM of each dNTP and 5mM MgCl<sub>2</sub>, and has been confirmed to be work well for most targets in restrict lab experiments. However, the optimal Magnesium concentration may range from 3 to 6 mM, and so if necessary, use the separate tube of 25mM magnesium sulfate to increase the magnesium concentration.



## IMPORTANT

It's very important for you to store the 5× Real-time PCR Master Mix in the dark.

---

## microRNA Specific RT primer 10μM

The miRNAs RT primer is a stem-loop like RT primer, with a miRNA specific region in the 3' end and provide better RT specificity and efficiency than linear ones. Base stacking of the stem enhance the thermal stability of the RNA-DNA hetero-duplex. Furthermore, spatial constraint of the stem-loop would likely improve the assay specificity in comparison to conventional linear RT primers.

---

## miRNA specific primer & probe Set 10μM

The pre-designed miRNAs primer and Molecular Beacon probe set are specific for mature miRNAs and can discriminate among related miRNAs that differ by as little as one nucleotide. For the sequence of primer sets, please log on <http://www.genepharma.com>

---

## Synthetic microRNA Standard 1 nmol

The synthetic miRNAs standard can work as a miRNA control when spiked into the total RNA extracted from tissue or cells. If the exact copy number of the miRNA in a certain amount RNA sample was wanted, you can dilute the synthetic miRNAs standard into 5~7 order of magnitude to make the standard curve and then calculate the copy number depend on the Ct value you got in the experiment.

---

## RNA Dilution buffer 1×

The 1X RNA Dilution Buffer is supplied with the kit for use in diluting the miRNA standard for the concentration magnitude of a standard curve. It is preferred to store the miRNA dilution at -80°C or -20°C.

---

## Taq DNA polymerase 5U/μl

For most PCR reaction, the final concentration of DNA polymerase was usually 0.05U/μl per reaction volume.

---

## User-Supplied Required Materials

---

### Reverse Transcriptase

For detection and quantification of the miRNAs in your sample, a RT reaction use the miRNA specific RT primer provided in the kit was needed. We recommended using traditional Reverse Transcriptase such as MMLV.

---

### RNase Inhibitor

To keep the activity of Reverse Transcriptase, adding RNase Inhibitor in your RT reaction was recommended. The final concentration usually was 0.25 U/  $\mu$ l.

---

### Rox reference dye

To normalize the fluorescence difference from well to well, adding Rox reference dye in your qPCR system was recommended when using the Real-Time PCR instruments such as ABI PRISM 7000/7300/7500/7900, MX3000p/4000.

---

### Optical PCR plates or tubes

As to eliminate the impact on fluorescence detection caused by PCR tubes or plates, using optical PCR plates and tubes was recommended to corporate the requirements of the Real-Time PCR instruments such as ABI PRISM 7000/7300/7500/7900, MX3000p/4000.

---

# Method

## Performing miRNAs RT Reaction

---

### Introduction

The Hairpin-it<sup>TM</sup> miRNAs real-time Quantitation assay of miRNAs includes two steps, stem-loop RT reaction and real-time PCR detection. Stem-loop RT primers bind to at the 3' end of miRNA molecules and are reverse transcribed with reverse transcriptase. Then, the RT product is quantified using real-time PCR that includes miRNA-specific forward primer, reverse primer and a dye-labeled Molecular Beacon probes.

To exactly quantifying the copy number of microRNA in a certain RNA sample, a standard curve should be established.

To profiling microRNA's expression relative to a said house-keeping gene, U6 snRNA or 5S rRNA qPCR Normalization Kit should be needed, see page 1 "Accessory products". For more detailed information about these two kits, please log on [http:// www.genepharma.com](http://www.genepharma.com).

---

### Handling the synthetic microRNA standard

The synthetic microRNA standard is supplied as 1 nmol dry powder Oligo stock. Following the guideline below when handling the synthetic microRNA standard stock.

- **Dilution:** Carefully open the tube, add 1ml RNA dilution buffer to dilute the stock to 1  $\mu$  M. Prepare another 1.5ml tube to dilute the 1  $\mu$  M microRNA standard solution to 0.1  $\mu$  M as work concentration to a probably volume.
  - **Storage:** It is important to store the 1  $\mu$  M microRNA standard solution and the 0.1  $\mu$  M work concentration solution at  $-20^{\circ}\text{C}$ . And it is preferred to store the solution at  $-70^{\circ}\text{C}$  for longer time.
  - **RNase-free conditions:** Take precautions to ensure that the stock solution does not become contaminated with RNase.
    - a. Use RNase-free sterile pipette tips and supplies for all manipulations.
    - b. Wear gloves when handling reagents and solutions.
- 

### Handling the microRNA RT primer

The microRNA RT primer is supplied as 10  $\mu$  M solution. Prepare another 1.5ml tube to dilute the 10  $\mu$  M microRNA RT primer solution to 1  $\mu$  M as work concentration to a probably volume using RNase free  $\text{H}_2\text{O}$ . Store the 10  $\mu$  M microRNA RT primer solution and the 1  $\mu$  M work concentration solution at  $-20^{\circ}\text{C}$ . For a standard microRNA RT reaction, the final concentration of RT primer is 50 nM.

---

*continued on next page*



## Performing miRNAs RT Reaction, continued

### Preparing The RT Reaction Mix

The template for the Hairpin-it™ miRNAs real-time Quantitation assay can be total RNA, cell lysate or purified microRNA. The RNA template's input range can vary from 0.2 ng to 200 ng or more as for as the requirement of the experiment. Other than the stability at 42°C, there is no special requirement of Reverse Transcriptase for the RT reaction. We recommended a standard 25 µl RT reaction size.

The following table provides RT reaction Mix volumes for a standard 25 µl reaction size.

Component	Final Con.	Vol /1 rxns
5×RT Buffer	1×	5 µl
DTT (0.1M)	0.01 M	2.5 µl
dNTP (10mM)	0.25 mM	0.75 µl
Mg <sup>2+</sup> (25mM)	3 mM	3 µl
MiR-RT primers (1 µM) <sup>1</sup>	50 nM	1.25 µl
RNasin (40U/µl)	0.4 U/µl	0.25 µl
MMLVReverse Transcriptase (200U/µl)	100 U	0.5 µl
RNA Sample (0.2 ng to 200 ng total RNA) <sup>2</sup>	0.2 ng to 200 ng	X µl
RNase Free H <sub>2</sub> O		To 25 µl

<sup>1</sup>See the **Important** note on handling the RT primer on page 6.

<sup>2</sup>Add 1 pg to 1 µg total RNA or mRNA to each reaction, the exact volume is feasible.

<sup>3</sup>Vortex the RT reaction reagents and Mix before RT reaction.

### Performing miRNAs RT Reaction

#### Standard RT Reaction Program

30 min at 16\_°C, 30 min at 42\_°C, 5 min at 85\_°C



#### NOTE

*Keep all components, reaction mixes and samples on ice. After assembly, transfer the reaction mixes to a thermal cycler preheated to the cDNA synthesis temperature and immediately begin RT reaction.*

## Performing miRNAs Real-Time PCR Reaction

### Handling the microRNA product

RT

For the Hairpin-it™ miRNAs real-time Quantitation assay, pipette 4 µl microRNA RT reaction product as the template for real-time PCR step subsequently. Store the surplus microRNA RT reaction product at –20°C.

### Preparing Real-Time Reaction Mix

The following table provides Real-time PCR reaction Mix volumes for a 40 µl reaction size. Note that preparation of a master mix is crucial in quantitative applications to reduce pipetting errors.

Component	Final Con.	Vol /1 rxns
5× Real-time PCR Buffer <sup>1</sup>	1×	8 µl
miR specific Primer set(10 µM) <sup>2</sup>	0.2 µM	0.8 µl
microRNA RT product		4 µl
Taq DNA polymerase (5U/ µl)	0.5 U/ µl	0.4 µl
dd H <sub>2</sub> O		To 40 µl

<sup>1</sup>The 1× Buffer contains 3mM Mg<sup>2+</sup>, 0.2mM dNTP, 0.2 mM Molecular Beacon probe.

<sup>2</sup>The miR specific Primer set includes PCR forward and reverse primers.

For multiple reactions, prepare a master mix of common components, add the appropriate volume to each tube or plate well, and then add the unique reaction components.

### Performing miRNAs Real-time PCR Reaction

Program the real-time PCR instrument to perform PCR amplification as shown below.

94°C for 3minute hold, 40 cycles of:

94°C, 15 seconds

**55°C, 25 seconds**

72°C, 25 seconds



#### NOTE

*Fluorescence detection step is at 55°C.*

### ROX Reference Dye

ROX Reference Dye can be included in the reaction to normalize the fluorescent reporter signal, for instruments that are compatible with that option. ROX is often supplied at a 25 µM concentration. Use the following table to determine the amount of ROX to use with a particular instrument:

*continued on next page*

## Performing miRNAs Real-Time PCR Reaction, continued

Instrument	Amount of ROX per 40 $\mu$ l reaction	Final ROX Conc.
ABI 7000, 7300, 7900HT	0.8 $\mu$ l	500 nM
ABI7500 Mx3000P, Mx4000	0.08 $\mu$ l	50 nM



### NOTE

To accurately pipette 0.08  $\mu$ l per reaction, dilute ROX 1:10 immediately before use and use 0.8  $\mu$ l of the dilution.

### Construction a standard curve

The synthetic miRNAs standard provided by this kit can work as a miRNA control when spiked into the total RNA extracted from tissue or cells. If the exact copy number of the miRNA in a certain amount RNA sample was wanted, you can construct a standard curve follow the recommendation step below:

1. Add 1ml RNA dilution buffer to dilute the synthetic miRNAs standard to 1  $\mu$  M stock. Prepare another 1.5ml tube to dilute the 1  $\mu$  M microRNA standard solution to 0.1  $\mu$  M as work concentration to a probably volume.
2. Dilute the 0.1  $\mu$  M synthetic miRNAs to 0.01  $\mu$  M by Spiking it into extracted total RNA sample, e.g. adding 1  $\mu$ l 0.1  $\mu$  M synthetic miRNAs stock per 10  $\mu$ l total RNA sample.
3. Dilute the spiked RNA sample into 6~8 order of magnitude with RNase free H<sub>2</sub>O.
4. Add **2  $\mu$ l RNA sample dilution** to 25  $\mu$ l RT reaction system.
5. Add **4  $\mu$ l RT reaction product** to 40  $\mu$ l real-time PCR system.
6. For the standard curve, the 2  $\mu$ l 0.01  $\mu$  M spiked RNA sample added into 25  $\mu$ l RT reaction system represents **5  $\times 10^8$  copies per reaction**.



### IMPORTANT

1. For multiple reactions, prepare a master mix of common components, add the appropriate volume to each tube or plate well on ice, and then add the unique reaction components (e.g., template). Preparation of a master mix is *crucial* in qRT-PCR to reduce pipetting errors.
2. Make sure that all components are at the bottom of the tube/plate; centrifuge briefly if needed.

# Appendix

## Technical Service

---

### World Wide Web

Visit the Invitrogen Web Resource using your World Wide Web browser. At the site, you can:

- ☐ Download manuals in Adobe Acrobat (PDF) format
- ☐ Explore our catalog with full color graphics
- ☐ Get the scoop on our hot new products and special product offers
- ☐ Obtain citations for Invitrogen products
- ☐ Request catalog and product literature

The Genepharma URL is [www.genepharma.com](http://www.genepharma.com)

---

### Quality Control

The product is tested functionally by qRT-PCR using total HeLa RNA as template. Kinetic analysis must demonstrate a linear dose response with decreasing target concentration and detection of GAPDH mRNA in 1 pg of total HeLa RNA.

---

### Contact Us

For more information or technical assistance, please call, write, fax, or email. Additional international offices are listed on our web page ([www.genepharma.com](http://www.genepharma.com)).

#### Corporate Headquarters:

Genepharma Corporation  
1011 Halei Road,  
Zhangjiang High-tech District,  
Shanghai, CHINA  
Tel: 86-21-51320195  
Fax: 86-21-51320295  
E-mail: [service@genepharma.com](mailto:service@genepharma.com)

---

©2005 - 2006 Genepharma Corporation. All rights reserved. For research use only. Not intended for any animal or human therapeutic or diagnostic use.