

miRCURY LNA™ microRNA Array Kit

6th generation - human, mouse & rat

Instruction manual v2.1

for product # 208400, 208401, 208402,
208420, 208421, 208422

March 2011

Table of Contents

Product Summary	4
miRCURY LNAT [™] microRNA Array Kit content	4
Additional required material	4
miRCURY LNAT [™] microRNA Array layout	5
Array probes specifications	6
How to use the Spike-in microRNAs	8
Scanner settings and array orientation	10
Storage	11
Protocol overview	12
Experimental workflow overview	12
Single or dual color	13
Labeling Protocol	15
Protocol & Notes	17
Hybridization Protocol	19
Hybridization and washing using Tecan HS Pro [™] hybridization stations	19
Hybridization and washing using an Agilent hybridization SureHyb chamber kit and gasket slide kit.	22
Hybridization and washing using NimbleGen/ MAUI [®] 4-Bay or 12-Bay hybridization stations.	26
Recommendations for Experimental Set-up and Data Handling	33
Software and Databases	37
ImaGene	37
Nexus Expression	37
Links to other array software	38

GenePix[™] Array List (GAL) files can be found at www.exiqon.com/Gal-downloads



Tips and Trouble Shooting	39
Experimental procedure	39
Preparation of RNA sample	39
Black spots - purification of the labeling reaction I	40
Concentration and purification of the labeling reaction II	40
Solid particles	41
Flushing the hybridization chamber	41
Dry slides	41
No signals	42
High signals	42
High background	42
Spike-in miRNA kit signal distribution	43
Sample signal distribution for Spike-in miRNA Kit v2 (product # 208041)	43
Sample signal distribution for Spike-in miRNA Kit (product # 208040)	44
References	45
Related Products	46

GenePix® Array List (GAL) files can be found at
www.exiqon.com/Gal-downloads



Product Summary

4

miRCURY LNA™ microRNA Array Kit content

Microarray slides

miRCURY LNA™ microRNA Arrays consist of control probes, and approximately 2383 capture probes, complementary to human, mouse, rat, and their related viral sequences from the v.16.0 release of miRBase. Arrays also contain a number of proprietary human miRPlus™ sequences not yet in miRBase.

Hybridization buffer (product # 208022)

Products with 3, 6 and 24 slides: 1 bottle x 5 mL

20x Salt buffer (product # 208023)

Products with 3 and 6 slides: 1 bottle x 125 mL

Products with 24 slides: 2 bottles x 125 mL

10% Detergent solution (product # 208024)

Products with 3 and 6 slides: 1 bottle x 15 mL

Products with 24 slides: 2 bottles x 15 mL

Spike-in microRNA kit v2 (product# 208041)

52 synthetic 5'-phosphorylated microRNAs, dried-down, 2x 24 reactions

Additional required material

miRCURY LNA™ microRNA Power Labeling Kit or miRCURY LNA™ microRNA Hi-Power Labeling Kit

Fluorescent labeling of microRNAs from total RNA samples ready for hybridization on arrays (product # 208030-A, 208031-A, 208032-A, 208033, 208034, 208035).

For manual hybridization

Microarray Hybridization Chamber - SureHyb (Agilent product# G2534A)

Hybridization Gasket Slide Kit (Agilent product# G2534-60003)

Hybridization oven with rotation. Glass staining jar/dish or equivalent.

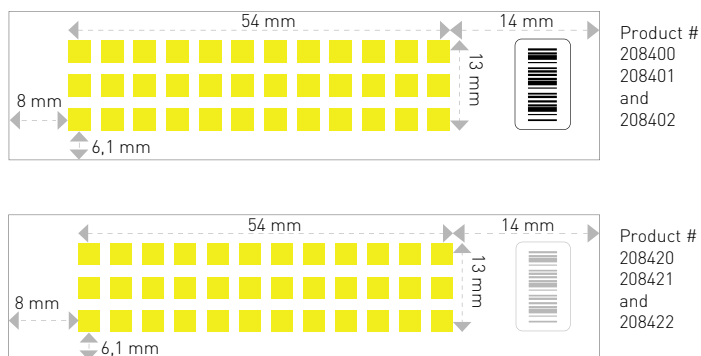


miRCURY LNA™ microRNA Array layout

The array is located on a standard-sized slide as illustrated in the drawing below (25.4 mm by 76.2 mm or 1 in by 3 in). The array carries the following specifications:

- Outer dimensions: 13 mm wide by 54 mm long
- 36 sub-arrays
- Spot size: 100 μm
- Distance between spots: 215 μm

Figure 1



To assist in orientation of the array and positioning of the image analysis grid, Hy3™ fluorescent labeled “landing lights” are present in all 4 corners plus one extra in lower right corner of the 36 sub-arrays, 180 total. The slides are compatible with all major brands of microarray scanners, that take glass slides of the above described specifications (1 x 3 inches, not Affymetrix and Illumina scanners).

The miRCURY LNA™ microRNA Array, REV (Figure 1, bottom image) which is accommodating MAUI®/NimbleGen™ mixers and hybridization stations is printed on the opposite side of the barcode.

6 Array probes specifications

T_m -normalized capture probes

The miRCURY LNA™ microRNA Array slides contain capture probes complementary to mature microRNAs registered in miRBase. The capture probes are Locked Nucleic Acid (LNA™) enhanced oligonucleotides. By varying the LNA™ content and length, the capture probes are T_m -normalized to hybridise optimally under the conditions described in this protocol.

Coverage of probe set

The slides contains capture probes for all microRNAs in human, mouse, rat and their related viruses as annotated in miRBase Release 16.0. Please go to www.exiqon.com/array to see the coverage in respect to latest version of miRBase. In addition, a number of capture probes are available for detection of microRNAs not included in miRBase. These miRPlus™ probes give researchers access to information unavailable elsewhere.

Please go to our online microRNA resource at www.exiqon.com/gal-downloads to:

- Download species-specific GenePix® Array Lists (GAL) files, consistent with the latest updates to miRBase. Please note the product number and lot# on the array slide box and on the slide pouch. This number is needed to identify the GAL file.

Control capture probes

A number of control capture probes are included in the probe set.

- Spike-in control probes to ensure optimal labeling and hybridization.
- Negative control capture probes.
- Capture probes complementary to small nuclear RNAs.

Please see table on the next page for details.



List of control probes

Probe ID	Positive controls	Aliases	Validated in these organisms
46202	5S_rRNA	-	hsa
145659	RNU1	U1; HSD1; RNU1; U1A1; HU1-1; RNU1A; RNU1A3; RNU1G4; Rnu1a1	hsa, mmu
145657	RNU5	U5a; Rnu5a	hsa, mmu
11278	RNU6-1	U6; RNU6; RNU6A	hsa, mmu, rno
11279	RNU6-1/RNU6-2	U6; RNU6; RNU6A / U6; RNU6B	hsa, mmu, rno
19011	SNORD10	mgU6-77	hsa
145661	SNORD110	HBII-55	mmu
19005	SNORD118	U8	hsa
19606	SNORD12	HBII-99	hsa
19603	SNORD13	U13	hsa
19013	SNORD14B	U14; U14B; RNU14B	hsa
19607	SNORD15A	U15A; RNU15A	hsa
19008	SNORD2	R39B; SNR39B	hsa
19007	SNORD30	U3; U3A; U3B	hsa
46204	SNORD38B	U38B; RNU38B	hsa
46206	SNORD44	U44; RNU44	hsa
46205	SNORD48	U48; RNU48	hsa
46203	SNORD49A	U49; U49A; RNU49	hsa
19604	SNORD4A	Z17A; RNU101A; mgh18S-121	hsa
19605	SNORD6	mgh28S-2412	hsa
145663	SNORD65	HBII-135	mmu
46197	SNORA66	HBII-142	hsa
145666	SNORD68	HBII-202	mmu
Probe ID	Negative controls	Validated negative control in these organisms	
14258	hsa_negative_control-1	hsa, mmu, rno	
14259	hsa_negative_control-2	hsa	
14260	hsa_negative_control-3	hsa, mmu, rno	
14266	hsa_negative_control-4	hsa, mmu, rno	
10901	hsa_negative_control-6	hsa, mmu, rno	
10902	hsa_negative_control-7	hsa, mmu, rno	
10903	hsa_negative_control-8	hsa, mmu, rno	

List of control probes: The different control capture probes were compared against the genomic sequence of hsa, mmu and rno, with the BLAST tools at www.ensembl.org. The right column show species for which the positive control probes have a perfect sequence match. Negative probes are listed with species for which they are designed as mismatch sequences.



Note

In the GAL-file, only capture probes relevant to the species in question are annotated with a name. Probes that do not have a name could be designed for another species, internal controls or obsolete probes no longer in use. Some of these may show signal although they are not annotated, but they should be ignored in the analysis.

Some capture probes have been optimized from previous versions of the miRCURY LNA™ Array. These will appear with a new probe ID on this array compared to earlier versions. For more details about comparisons to older versions of the arrays, please contact www.exiqon.com/contact.

How to use the Spike-in microRNAs

The miRCURY LNA™ microRNA Array Spike-in kit v2 contains 52 different synthetic unlabeled microRNAs in different concentrations. The set can be spiked into an RNA sample prior to labeling and the synthetic Spike-in kit v2 will hybridize to corresponding capture probes on the miRCURY LNA™ microRNA Array. Spike-in microRNAs added in equal amounts to the different labeling reactions before hybridization can be used to improve the data quality as control for the labeling reaction or in calibrating the scanner settings as well as for normalization and assessing the technical variability between different part of the array experiment:

- If the variation between replicates of each of the four spike-in controls exceed 20-25%, it could be an indication of insufficient agitation of the sample.
- Inter- as well as intra correlations between all 52 spike-in miRNAs are normally within 0.950 and 0.999 (R2).

The Spike-in miRNA kit v2 has been designed and tested not to cross-react with endogenous microRNAs from human, mouse or rat, and is provided at concentrations compatible with endogenous microRNA expression levels. The Spike-in kit v2 is supplied with different concentrations of synthetic spike-in microRNAs aimed at spanning the whole intensity range of microRNAs in most tissue samples.



Each spike-in miRNA has 4 replicates of capture probes on the array. Four of the capture probes (ID # 27968, 28568, 28684 and 29001) are printed in two diagonals in each of the 36 subgrids (see figure 4). A smaller spike-in miRNA kit (product # 208040) is also available for the potential use of hybridization control. See signal distribution details for both kits in the tips section.

List of capture probes for Spike-in miRNA Kit v2

Probe	ID Name
1100	spike_control_v2_1
13186	spike_control_v2_2
13367	spike_control_v2_3
13371	spike_control_v2_4
13388	spike_control_v2_5
13389	spike_control_v2_6
13393	spike_control_v2_7
13417	spike_control_v2_8
13421	spike_control_v2_9
13430	spike_control_v2_10
24127	spike_control_v2_11
24136	spike_control_v2_12
24163	spike_control_v2_13
24199	spike_control_v2_14
24217	spike_control_v2_15
24226	spike_control_v2_16
25557	spike_control_v2_17
25593	spike_control_v2_18
25611	spike_control_v2_19
25728	spike_control_v2_20
26160	spike_control_v2_21
27291	spike_control_v2_22
27318	spike_control_v2_23
27350	spike_control_v2_24
27676	spike_control_v2_25
27821	spike_control_v2_26

Probe	ID Name
27833	spike_control_v2_27
27953	spike_control_v2_28
27968	spike_control_v2_29*
28038	spike_control_v2_30
28098	spike_control_v2_31
28393	spike_control_v2_32
28444	spike_control_v2_33
28488	spike_control_v2_34
28568	spike_control_v2_35*
28581	spike_control_v2_36
28684	spike_control_v2_37*
28876	spike_control_v2_38
28929	spike_control_v2_39
29001	spike_control_v2_40*
29056	spike_control_v2_41
29138	spike_control_v2_42
29146	spike_control_v2_43
29544	spike_control_v2_44
29564	spike_control_v2_45
29837	spike_control_v2_46
30147	spike_control_v2_47
30207	spike_control_v2_48
30293	spike_control_v2_49
30747	spike_control_v2_50
30756	spike_control_v2_51
32812	spike_control_v2_52

List of Spike-in miRNA kit v2 capture probes and their probe ID's:

* Indicates that these probes are printed in two diagonals in all subgrids. 72 + 4 replicates in total (see tip 12 for layout overview). The different control and spike-in miRNA capture probes were compared against the genomic sequence of hsa, mmu and rno, with the BLAST tools at www.ensembl.org.

Scanner settings and array orientation

4 of the spike-in control probes (marked with * on page 9) are located in two diagonals, each in a total of 72 replicas. When scanning the images, these spike-in capture probes can be used to determine appropriate scanner settings. If spike-in mix is added in equal amounts to both RNA samples, the signal from the spike-in capture probes should be similar in both channels after scanning for dual color experiments. First find a laser power setting that gives the expected signal range and then adjust PMT settings so that both channels give similar signal in the spike-in capture probes.

The landing lights (annotated as Hy3™ in the gal-file, probe ID 13138) should not be used for finding the proper scanner settings as these spots contain dye spotted directly on the arrays. The intensity of these spots may vary from batch to batch of slides. These spots are only included for gal-file orientation, and their corresponding data points should be removed prior to normalization of the dataset.

Figure 2

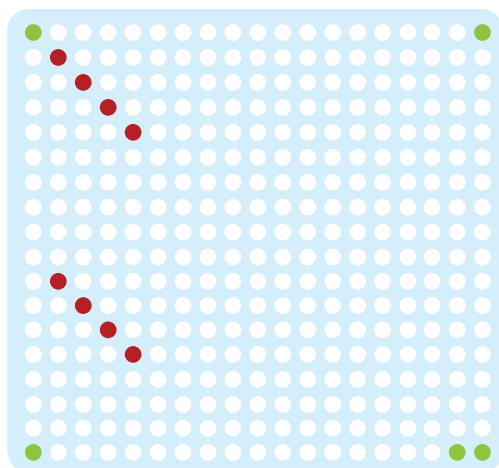


Figure 2. The location of spike-in capture probes in each subgrid on miRCURY LNA™ Arrays. The green spots are the Hy3 landing lights. The red spots in the diagonal are probe # 29001, 28684, 28568 and 27968 counting from upper left, targeting complementary RNA's in the Spike-in miRNA v2 kit.

- Std probes (4 replicates)
- Landing light
- Control probes (replicates in all 72 subgrids)

Storage

miRCURY LNA™ microRNA Arrays should be stored desiccated at room temperature and protected from light. When properly stored, arrays will remain hybridization competent for at least 12 months from production date. The arrays are shipped in desiccated, re-sealable storage pouches that are ideal for this purpose. Both the storage pouches and slide storage boxes are manufactured from materials that minimize outgassing and effectively block exposure to foreign contaminants that can elevate background levels. When accessing arrays, remove only the arrays you plan to immediately use and return the remaining arrays to the pouch quickly, leaving the desiccant pack in place.

Dissolve the miRCURY LNA™ Array Spike-in miRNA Kit v2s in 30 μ L/vial (see important note page 16) of RNase free water (supplied) upon receipt. Vortex to thoroughly dissolve the lyophilized RNA, pulse briefly in a microfuge, and leave the suspension on ice for 30 min. to dissolve. Vortex and then spin to collect tube contents. Store the dissolved Spike-in microRNA at -20° C until use and avoid repeated cycles of freeze/thawing. You may wish to aliquot the dissolved spike-in microRNAs to avoid repeated freeze/thawing. For long-term storage, keep the vial at -80° C.

If stored properly, shelf life for the miRCURY LNA™ Array Spike-in miRNA kit v2s is 12 months. In solution, the shelf life for the spike-in microRNAs is 3 months.

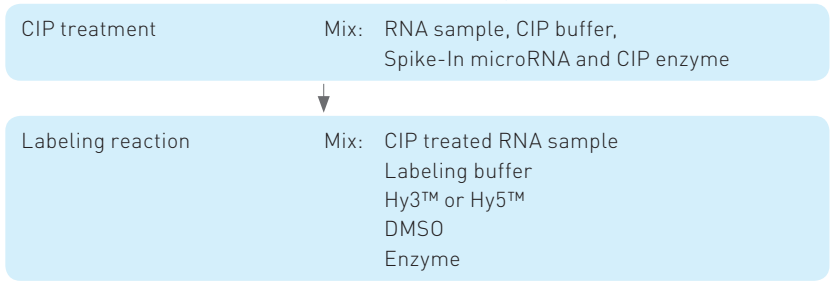


Protocol overview

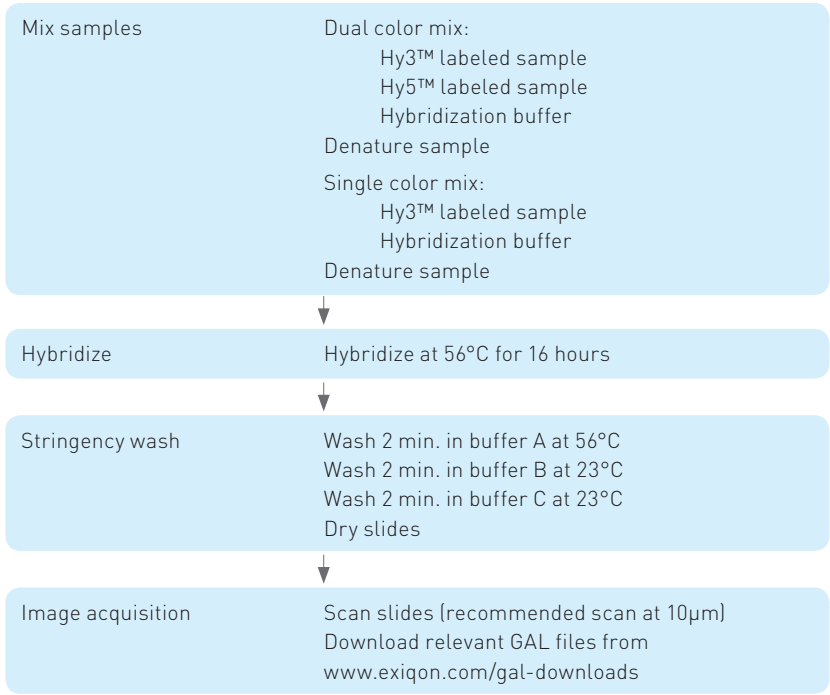
12

Workflow for the complete microRNA array experiment combining the sample labeling and array hybridization protocol

miRCURY LNA™ microRNA Hi-Power Labeling Kit



miRCURY LNA™ microRNA Array Kit



Tip: For a visual presentation of the labeling procedure and a manual hybridization, please view the instructional movie at www.exiqon.com/e-talk

Single or dual color

Arrays can either be run as dual color (Hy3™ vs Hy5™) or single color (Hy3™ only). A schematic overview of advantages and disadvantages as well as recommended data analysis method can be seen in this table:

Dual color

Advantages:

- Lowess normalization reduces differences caused by experimental variation
- Lowess normalization reduces day to day variation
- Ratio data are typically more robust than absolute signals

Disadvantages:

- With common reference: Can only be done on a limited project with known number of samples and requires double the amount of RNA.
- With universal reference: miRs expressed in samples but not in reference are measured inaccurately.
- Hy5™ is sensitive to ozone and might pose problems especially in urban areas if counter measures have not been taken in the lab to ensure low ozone levels
- Requires double the amount of RNA sample than single color

Data analysis:

- Local background subtraction (or norm exp)
- Lowess normalization



Single color*

Advantages:

- Enables comparison across experiments
- Ability to add more samples to an experiment later

Disadvantages:

- Requires extremely high lab standards and very reproducible handling of samples
- Experiments performed over a large time span are sensitive to minor lot to lot variations

Data analysis:

- Local background subtraction (or norm exp)
- Quantile normalization

*Single color is only supported if the RNA is labeled using the miRCURY LNA™ microRNA Array Hi-Power labeling kit or miRCURY LNA™ microRNA ArrayPower labeling kit, and Exiqons buffers etc.

Experimental design

If running single color, each sample has to be labeled with Hy3™, and hybridized to individual arrays. If running dual color, it is recommended that each sample is labeled with Hy3™ and that the reference is labeled with Hy5™. As reference we recommend to use either a common reference or a universal reference.



Labeling Protocol

(product # 208033, 208034, 208035)

Before starting the experiment

Total RNA should be prepared using a method that preserves small RNA species. When using commercially available kits, please verify that the total RNA preparation contains small molecular weight RNAs. We recommend using the miRCURY™ RNA Isolation Kits for total RNA preparations. For labeling, we recommend that you use miRCURY LNA™ microRNA Hi-Power Labeling Kit or miRCURY LNA™ microRNA Power Labeling Kit. Please visit www.exiqon.com to learn more about these products.

See tip
1

The amount of total RNA to be labeled for an array hybridization depends on the microRNA content of the cells or tissue being analyzed. Without prior knowledge of microRNA content in the sample, we recommend using between 250 ng and 1 µg of total RNA per labeling reaction.

Prior to performing the labeling, dissolve the fluorescent dye(s) by adding 29 µL of nuclease-free water to the tube with the labeling dye, followed by vortexing and a brief centrifugation to collect the content of the tube.

Important note:

Minor lot variations of the labeling dyes may occur. For optimal performance of dual color hybridization with Hy3™ and Hy5™ labeled RNA, it is recommended to use matched pairs of Hy3™ and Hy5™ labels. The miRCURY LNA™ microRNA Array, Hi-Power labeling kit (product # 208035) and miRCURY LNA™ microRNA Array, Power labeling kit (product # 208032-A) always contain matching pairs of dyes.

Dissolve the spike-in miRNAs in 30 µL of RNase free water supplied upon receipt. Leave the suspension on ice for 30 minutes to dissolve. Vortex and then spin to collect tube contents. Store the dissolved Spike-in miRNA at -20° C until use and avoid repeated cycles of freeze/thawing. You may wish to aliquot the dissolved spike-in miRNAs to avoid repeated freeze/thawing. For long-term storage, keep the vial at -80° C.



Important note:

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If both the Spike-in miRNA kit v2 (supplied with the arrays) and the Spike-in miRNA kit (Product # 208040) are to be used in the labeling reaction, it is recommended to dissolve both tubes in 15 μ L RNase free water. Leave the suspensions on ice for 30 minutes to dissolve. Vortex and then spin to collect tube contents. Finally mix the two in one tube and store at -20° C until use and avoid repeated cycles of freeze/thawing. You may wish to aliquot the dissolved spike-in miRNAs to avoid repeated freeze/thawing.

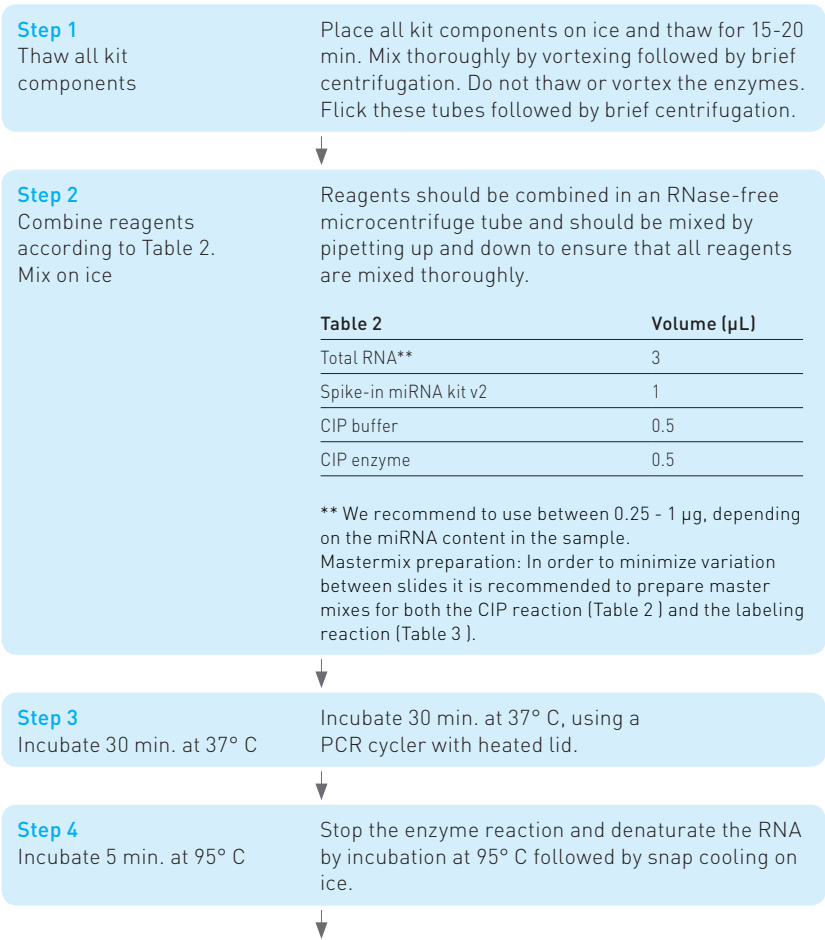
For the labeling reactions, 1 μ L of this joint spike-in mix is used instead of 1 μ L Spike-in miRNA kit v2.



Protocol & Notes

Protocol

Total handling time: 1 hour



Step 5

Incubate 2 min. on ice.

Leave on ice for at least 2 min. and up to 15 min. Briefly spin the reaction after incubation on ice.

**Step 6**

Combine reagents listed in Table 3. Mix on ice

Add the reagents listed in Table 3 to the 5 μL CIP reaction from step 5.

Table 3	Volume (μL)
CIP reaction from step 5	5
Hi-Power Labeling buffer	3
Fluorescent label (Hy3™ or Hy5™)	1.5
DMSO	2
Hi-Power Labeling enzyme	1

Mastermix preparation: In order to minimize variation between slides it is recommended to prepare master mixes for both the CIP reaction (Table 2) and the labeling reaction (Table 3).

**Step 7**

Mix and centrifuge the reagents briefly

Reagents should be mixed by gentle vortexing or by pipetting up and down to ensure that all reagents are mixed thoroughly.

**Step 8**

Incubate **2 hours** at 16° C

Incubate for 2 hours at 16° C, using a PCR cycler with heated lid. Protect the reaction from light.

**Step 9**

Incubate for 15 min. at 65° C

After stopping the labeling procedure, briefly spin the reaction and leave it at 4° C. The labeled sample is now ready for hybridization on the array. Hybridization should preferably occur within 1-2 h.



Hybridization Protocol

Hybridization and washing using Tecan HS Pro™ hybridization stations

Before starting the experiment

For labeling, we recommend using the miRCURY LNA™ microRNA Hi-Power Labeling Kit. Please visit www.exiqon.com to learn more about this product.

The amount of total RNA to be labeled for an array hybridization depends on the microRNA content of the cells or tissue being analyzed. Without prior knowledge of microRNA content in the sample, it is recommended using between 250 ng and 1 µg of total RNA per labeling reaction.

Check the hybridization buffer for any precipitate. If necessary, warm the solution at 56° C and agitate to dissolve the precipitate completely.

Please refer to the instruction manual of your hybridization station for correct volume of buffers required to perform the hybridization.

The volumes in Table 1 applies to the hybridization of 4 slides in a Tecan HS400/HS4800 hybridization station.



Table 1

Recipes for preparation of 200 mL Wash buffers

	Wash buffer A	Wash buffer B	Wash buffer C
20x Salt buffer	20 mL	10 mL	2 mL
10% Detergent solution	4 mL	-	
Nuclease-free water	176 mL	190 mL	198 mL

Protocol

Total handling time: 1 hour

Step 1

Combine the labeled sample(s)

If running a dual color experiment, the two samples from the Hy3™ and Hy5™ labeling reactions are combined on ice.
If the experiment is single color, 12.5 µL RNase free water is added to the labeling sample. Total volume should be 25 µL.

See tip
2**Step 2**Add 25 µL
2x Hybridization buffer

Check for precipitation (see p. 17) in the hybridization buffer before adding 25 µL to the labeled sample(s). Mix by vortexing and spin briefly.

Step 3

Denature 2 min. at 95° C

During the incubation the target preparation should be protected from light.

See tip
4**Step 4**

Incubate 2 min. on ice

Leave on ice for at least 2 min. and up to 15 min. Briefly spin the reaction after ice incubation.

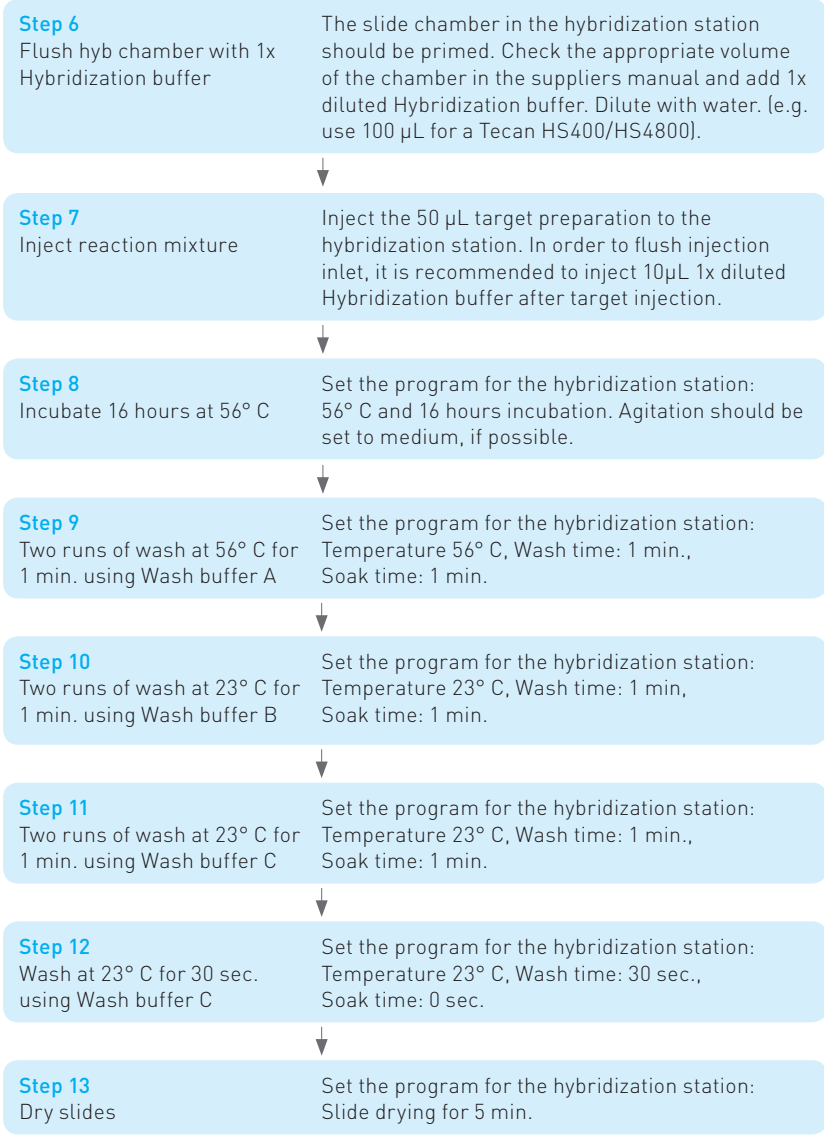
Step 5

Preparation of Tecan

Load slides in hybridization chambers. Set the program for the hybridization station: Prewash the slides with wash buffer A. Temperature 56°C, Wash time: 30 sec., Soak time: 0 sec.



See tip 5



Hybridization and washing using an Agilent hybridization SureHyb chamber kit and gasket slide kit

For optimal quality, it is recommended to use an automatic hybridization station, e.g. Tecan HS Pro hybridization station (see procedure at page 19). If a hybridization station is not available, manual hybridization can be carried out according to the protocol in this section using an Agilent hybridization SureHyb chamber kit and gasket slide kit. Please contact www.exiqon.com/contact for an alternative protocol using cover slip.

Additional required materials:

Hybridization Chamber Kit - SureHyb enabled, Agilent part # G2534A
Hybridization Gasket Slide Kit (5) - 1 microarray per slide format, Agilent part # G2534-60003
Hybridization oven with rotation (e.g. SciGene, # 400 or Agilent).
Ethanol 99%
Hybridization chamber user guide (G2534-90002)

Before starting the experiment, day 1

We recommend using the miRCURY LNA™ microRNA Hi-Power labeling kit for labeling of your sample(s). Please visit www.exiqon.com to learn more about this product.

Check the hybridization buffer for any precipitate. If necessary, warm the solution at 56° C and agitate to dissolve the precipitate completely.



Before starting the experiment, day 2

Glass staining jar/dish and Wash buffer A should be placed at 56° C before starting the experiments at day 2.

If one or two miRCURY LNA™ microRNA Arrays are processed together in an experiment, the arrays could be washed in a 50 mL screw-top tube (e.g. Falcon) by gently inverting the tube. If three or more miRCURY LNA™ microRNA Arrays are processed in an experiment the arrays could be placed in a slide rack and washed in a glass staining jar/dish. Use appropriate volume of washing buffer to cover the slides and shake gently. The volumes in Table 2 below are required for a large glass staining dish (8 slides, Sigma-Aldrich product # S-S6016 or similar). The following protocol is for hybridization of miRCURY LNA™ microRNA Arrays using an Agilent Hybridization chamber - SureHyb.

An instructional video on how to perform the hybridization using SureHyb Chambers can be found here: www.exiqon.com/e-talk

Table 2

The volumes in this table are required for glass staining jars of 200 mL.

Recipes for preparation of Wash buffers

	Wash buffer A	Wash buffer B	Wash buffer C
20x Salt buffer	60 mL	20 mL	2 mL
10% Detergent solution	12 mL	-	-
Nuclease-free water	528 mL	380 mL	198 mL



Protocol

Total handling time: 1 hour

Step 1

Prepare the labeled sample(s)

Adjust the volumes of the labeled sample to 200 μL by adding nuclease free water to the labeled sample(s) (kept on ice). If running a dual color experiment, combine the two samples from the Hy3™ and Hy5™ labeling reactions before adjusting the volume.

See tip
2

Step 2

Add 200 μL
2x hybridization buffer

If there is precipitation in the Hybridization buffer, then warm the solution at 56° C and agitate to dissolve. Add 200 μL to the labeled sample(s). Mix by vortexing and spin briefly.

Step 3

Denature 2 min. at 95° C

During the incubation the target preparation should be protected from light.

See tip
4

Step 4

Incubate 2 min. on ice

Leave on ice for at least 2 min. and up to 15 min. Briefly spin the reaction after ice incubation.

Step 5

Add 400 μL to reservoir

Add 400 μL of the target sample mixture to the reservoir of backing gasket slides. Place the slide on top of the the backing gasket slides with the array side facing the target samples.

Step 6

Incubate 16 hours at 56° C

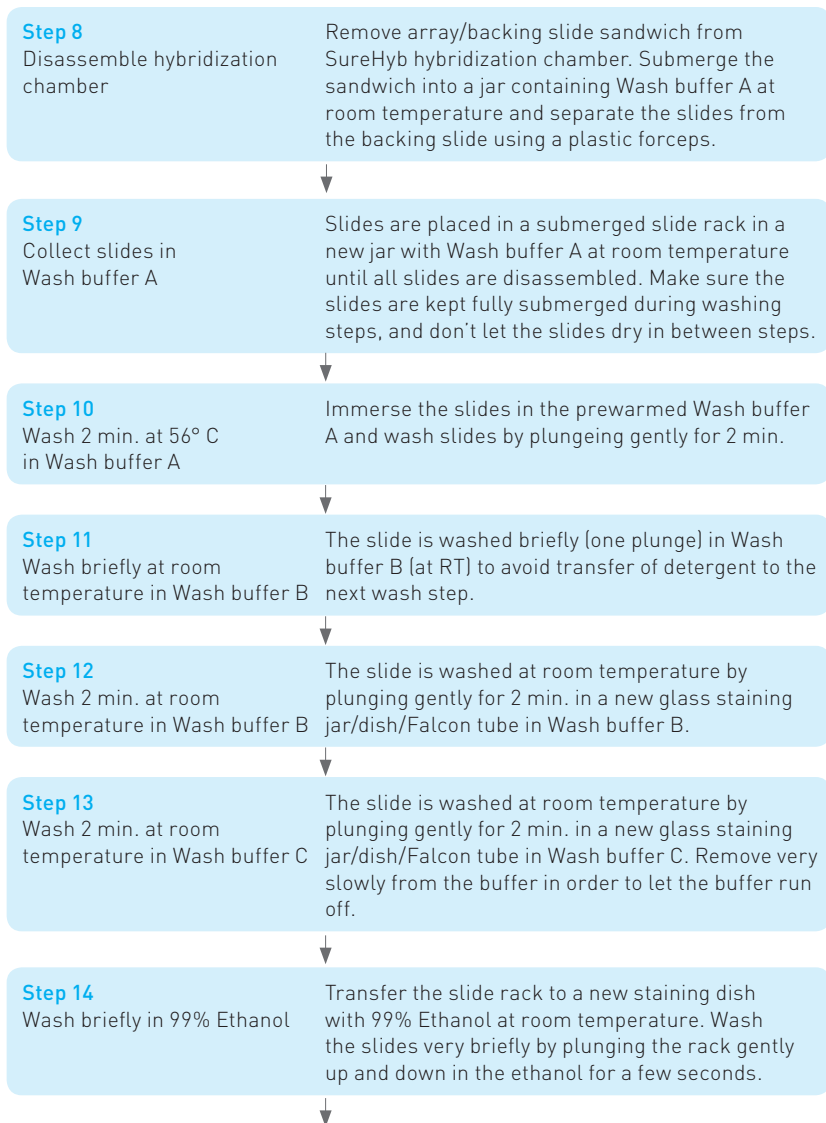
Clamp the array/backing slide sandwich into the SureHyb hybridization chambers and make sure all bubbles move freely. Incubate at 56° C for 16 h. in a hybridization oven with rotation (e.g. SciGene, #400).

Step 7

Place Wash buffer A at 56° C overnight

Pre-warm the glass staining jar/dish and Wash buffer A by placing them at 56° C.





Step 15

Dry the slide(s)

Dry the slides by centrifugation for 5 minutes at 1000 rpm. At this stage the fluorophores on the slides are very susceptible to degradation by ozone in atmospheric air. Keep ozone-induced photo bleaching to a minimum by working in an ozone free lab or keeping the slides under a controlled atmosphere. Scan slides immediately after drying.

See tip
6

Hybridization and washing using NimbleGen/ MAUI® 4-Bay or 12-Bay hybridization stations

This Protocol provides information for the use of Exiqon miRCURY LNA™ Arrays with the NimbleGen/ MAUI® Hybridization System using a NimbleGen HX1 mixer. The protocol is designed for the arrays that are printed on the opposite side of the slide compared to the barcode [prod. # 208420, 208421 and 208422].

The NimbleGen/ MAUI® Hybridization System is comprised of two main components, the disposable NimbleGen Mixer hybridization chambers and NimbleGen/ MAUI® instrument that powers the mixing bladders in the Mixer and maintains a constant incubation temperature. The NimbleGen Mixer adheres to the microarray slide via an adhesive gasket forming a uniform, low volume, sealed hybridization chamber. Once attached, the Mixer-slide is clamped into one of the heated slide bays in the base unit, where hybridization takes place. For details about using the NimbleGen/ MAUI® Hybridization System please see the User's Guide that come with the Hybridization System.



Additional required materials:

RNA samples (labeled with miRCURY LNA™ Hi-Power Labeling Kit)
 NimbleGen HX1-mixers
 NimbleGen Precision mixer alignment tool (PMAT)
 NimbleGen Mixer Disassembly Tool
 NimbleGen Gasket brayer
 Positive Displacement Pipette (optional, but highly recommended)
 Wide pipette tips (see filling video at www.exiqon.com)
 7 Rectangular Staining Dishes, 250 mL, w/slide washing racks
 (e.g. Wheaton # 900200 /VWR# 25461-003).
 Heating block set to 56° C.
 Oven set to 56° C.

Before starting the experiment, day 1

We recommend using the miRCURY LNA™ microRNA Hi-Power Labeling Kit for labeling of your sample(s). Please visit www.exiqon.com to learn more about this product.

Check the hybridization buffer for any precipitate. If necessary, warm the solution at 56° C and agitate to dissolve the precipitate completely prepare the wash buffers and leave min. 500 mL Wash Buffer A in an oven at 56° C over night. Leave 2 Rectangular Staining Dishes in the oven at 56° C as well.

Table 2

The volumes in this table are required for glass staining jars of 200 mL.

Recipes for preparation of Wash buffers

	Wash buffer A	Wash buffer B	Wash buffer C
20x Salt buffer	60 mL	20 mL	2 mL
10% Detergent solution	12 mL	-	-
Nuclease-free water	528 mL	380 mL	198 mL

Protocol

Step 1

Attach the NimbleGen HX1-mixer to the miRCURY LNA™ Array

For details on how to assemble the mixer and the array slide please see the NimbleGen User's Guide. Briefly:

- Remove the miRCURY LNA™ Array from the slide box.
- Insert the array slide in the PMAT with the barcode facing down and away from the hinge.
- Place the HX1 mixer in the lid of the PMAT with the end of the mixer towards the hinge and the mixer's adhesive gasket facing outward. Remove the protective lining from the mixer using a forceps and close the lid of the PMAT and carefully press the mixer.
- Remove the mixer-slide assembly from the PMAT and place the assembly with the mixer side up on a heating block at 56° C for 5 min.
- Use the NimbleGen Gasket brayer and moderate pressure to ensure good mixer to slide adhesion.
- Leave the mixer-slide assembly with the mixer side upon the heating block at 56° C. The sample must be loaded onto the 56° C-heated slide within 30 min of assembly.



Step 2

Prepare the labeled sample(s)

If running a dual color experiment, the two samples from the Hy3™ and Hy5™ labeling reactions are combined on ice. If the experiment is single color, 12.5 µL RNase free water is added to the labeled sample. Total volume should be 25 µL.

See tip
2



Step 3
Add 25 μL
2X Hybridization buffer

Add 25 μL 2X Hybridization buffer to the labeled sample(s). Mix by vortexing and spin briefly. Final volume 50 μL .

Step 4
Denature 2 min. at 95° C

During the incubation the target preparation should be protected from light.

Step 5
Cool 2 min. on ice

Leave on ice for at least 2 min. and up to 15 min. Briefly spin the reaction after ice incubation. Heat the sample to 56° C for 2 min. prior to loading into the slide-mixer assembly.

Step 6
Load the sample into the pre-heated HX1-mixer-slide assembly

Briefly spin the pre-heated sample prior to opening the tube. Aspirate 45 μL of sample into the pipette by pipetting up and down a few times (avoid bubbles).



Step 6 (Continued)

Load the sample into the pre-heated HX1-mixer-slide assembly.

- Insert the pipette tip into the fill port in the tab-end of the HX1-mixer and carefully inject the sample into the chamber at a moderate speed until sample emerges from the vent port (if sample is injected too slowly, a bubble might form). The actual volume of the HX1-mixer varies slightly from batch to batch, so do not be alarmed should some of the sample bubble up from the vent port.
- Keep the plunger depressed and remove the pipette tip from the fill port. Any excess sample from the fill and vent ports are wiped clean with a tissue.
- Using forceps, place adhesive port seals directly over both ports. Use a finger on each port seal and press down firmly on both seals simultaneously to seal the ports.

**Step 7**

Incubate 16 hours at 56° C

Place the loaded slide-mixer assembly in one of the bays of a NimbleGen mixer, close the lid and incubate at 56° C for 16 h with mixing mode B.

**Step 8**

Preparation of washing procedure

In preparation of next day's washing procedure pre-heat min. 500 mL Wash Buffer A at 56° C overnight. Leave 2 Rectangular Staining Dishes in the oven at 56° C as well.

**Step 9**

Prepare wash buffers

At room temperature prepare the following washing solutions, each in a separate staining dish. Add sufficient liquid to completely cover the slides when they are placed in a washing rack in the staining dish: Wash A, B and C buffer according to table 2. Ethanol, 99%.



Step 10

Disassemble HX1-mixer and slide

Perform the following operations at 56° C by working in the door opening of an oven:

- A. Place the mixer/slide assembly in the Mixer Disassembly Tool in the heated staining dish and add sufficient pre-heated Wash Buffer A to cover it.
- B. To the other pre-heated staining dish add sufficient Wash Buffer A to completely cover the slides when placed in the washing rack.
- C. Remove the HX1-mixer from the slide and quickly insert it into the submerged washing rack to avoid cooling of the slide.

Step 11

Wash 2 min. at 56° C in Wash buffer A

- D. Wash the slide for 2 min at 56° C by gentle plunging of the slide rack.
- E. Transfer the slide to the rack in Wash Buffer B
- F. Repeat steps C to F for each slide in the NimbleGen Hybridization Station, collecting the slides submerged in Wash Buffer B at room temperature.

Step 12

Wash 2 min. at room temperature in Wash buffer B

When all slides have been collected in Wash Buffer B, wash the slides for additional 2 minutes by plunging the rack gently up and down in the buffer at room temperature. Make sure the slides are kept fully submerged during washing steps, and don't let the slides dry between steps.

Step 13

Wash 2 min. at room temperature in Wash buffer C

Transfer the slide rack to a new staining dish with Wash Buffer C at room temperature. Wash the slides for 2 minutes by plunging the rack gently up and down in the buffer. Remove very slowly from the buffer in order to let the buffer run off.



Step 14

Wash briefly in 99% Ethanol

Transfer the slide rack to a new staining dish with 99% Ethanol at room temperature. Wash the slides very briefly by plunging the rack gently up and down in the ethanol for a few seconds.

**Step 15**

Dry the slide(s)

Dry the slides by centrifugation for 5 minutes at 1000 rpm. At this stage the fluorophores on the slides are very susceptible to degradation by ozone in atmospheric air. Keep ozone-induced photobleaching to a minimum by working in an ozone free lab or keeping the slides under a controlled atmosphere. Scan slides immediately after drying.

See tip
5



Recommendations for Experimental Set-up and Data Handling

As mentioned earlier (page 13), it is possible to hybridize one sample (i.e. single color) or two samples (i.e. dual color) to one array. Since microarray expression profiling without appropriate standards cannot be used for absolute quantification, expression levels of a microRNA in a sample can only be determined in comparison to other samples. In single color experiments, each sample is hybridized to a separate array; the comparison must then occur between arrays.

So far there are no established or thoroughly tested control or housekeeping small ncRNAs or microRNAs that can be used as common factors for normalization. The only options for single-color experiments are the use of the characteristic signal distributions, assuming that the similarity between the samples is high enough to allow normalization, or the use of synthetic spiked-in microRNAs. A set of spiked-in control microRNAs could also be an option, but again, it has to be considered that the number of spots used is limited and may thus introduce bias.

A way to enable optimal normalization across arrays is to use dual-color arrays with a common reference sample or a universal reference on all arrays in the study. Once intra-slide normalization has taken place, the log₂ ratios between sample and reference for each microRNA can be calculated allowing the immediate direct comparison of all log₂ ratios from all slides. The fact that all microRNA signals are expressed as a ratio to a reference, which should be the same on each slide, in essence removes technical variations from the comparison.

For help on designing array experiments, an overview can be downloaded from www.exiqon.com/array:Guidelines_for_setting_up_microRNA_array_profiling_exp.pdf

Protocol

Step 1 Scanning

We are using an Agilent G2505B Microarray Scanner System. The scanning is normally performed with 10 μm. The sensitivity should be adjusted to 100% PMT. To avoid ozone bleaching, we scan the microarrays in an ozone-free environment (less than 2 ppb ozone). Before starting any analysis, confirm that the tiff image is in the correct orientation (two landing lights in lower right corner). Depending on the scanner, the image may need to be flipped from upper left to lower right.



Step 2

Spot evaluation and background subtraction

In general, we recommend using local background subtraction. We subtract the local median background signal from each spot using the Exiqon-tailored ImaGene data analysis software (see www.exiqon.com/mirna-array-software). When using more advanced background subtraction, 'Normexp plus offset' convinced us with satisfying results. We are not using Feature Extraction software (Agilent) on a routine level. However, we provide a short protocol for customers who like to use this software (www.exiqon.com/array).

**Step 3**

Normalization

When running a dual color experiment we recommend a lowess intra-slide normalization for the signal intensities of each channel as a minimum. This eliminates the dye- and label-specific variances. In addition, it is recommended to monitor inter-slide comparability based on the spike-ins and or signals derived from constantly expressed RNAs. If running single color experiments we recommend to normalize the data using the quantile normalization method, as we have found that this generates the most reliable data.

Both of these normalization methods are supported in the Nexus software, part of the (the Exiqon array data analysis supplied software package, for details see www.exiqon.com/mirna-array-software) miRCURY LNA™ microRNA Arrays contain several control capture probes (e.g. detecting U6 snRNA and snoRNAs) and the signal obtained from these probes could theoretically be used in normalization after confirming the constant expression of these small RNAs under the given experimental conditions. However, we believe that normalization based on these very few probes alone is not optimal. Therefore, we recommend using these control capture probes to monitor the analyzed samples for uniformity and not for normalization.



Step 3 (Continued)

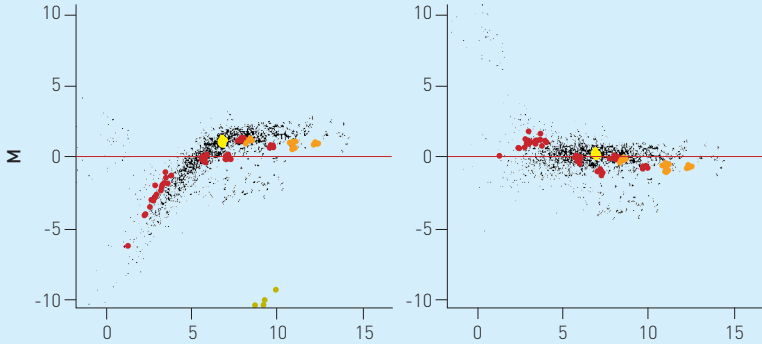
In theory, it is possible to use signals from a set of spike-in synthetic microRNAs (added to each labeling reaction and for which control capture probes exist) to perform normalization. However, apart from being something synthetic added to the samples, the use of spike-ins for normalization focuses on a small number of data points, which is a problem if the differences between the samples are very large or if something in the samples themselves affect the synthetic microRNAs during labeling or hybridization. Exiqon offers two different spike-in kits. The one supplied with the array (spike-in miRNA kit v2, 208041), contains 52 synthetic miRNAs and could in theory be used for normalization, although we recommend using all detection probes instead. The other (spike-in kit, 208040) only contains 10 different miRNAs and can be used for control of the hybridization (see page 8), while it is recommended not to be used for normalization.

**Step 4****Data analysis and visualization**

From each spot and each channel the median signal intensity obtained after image analysis should be measured and normalized (after either local background subtraction or normexp plus offset background subtraction). The difference of a normalized and an unnormalized dataset can be seen in the MA plots below. For each of the normalized four replica datasets, the ratio between the Hy3 and Hy5 channels is determined.

The way the actual comparison is performed depends on the experimental setup. For direct comparison, the log ratios can be used directly. For common /universal reference comparisons log₂ differences between sample are compared indirectly between the slides by using the common reference as normalizer added up to obtain the difference between the samples. We recommend using the special tailored Exiqon-offered Nexus software (see www.exiqon.com/mirna-array-software), that calculates significant differentially expressed miRs across samples and visualizes this in heatmaps/cluster diagrams.



Step 4 (Continued)

Two color intra-slide MA-plots obtained before (left) and after (right) lowess intra-slide normalization. Colored spots represent spike-ins of different signal intensities.

**Step 5**

Data evaluation

We strongly advise users to evaluate the microRNA data for their cluster and family performance. MicroRNAs which cluster in close proximity are expected to react similarly in their expression pattern, due to common transcriptional activity. MicroRNA families can be interesting to analyze since they may react similarly due to their common target sequences and help understanding how family members are tissue-specifically regulated. An analysis of how the data of families or clusters correlate can therefore provide relevant data in addition to the actual microRNA signal of initial interest. Additionally, a further analysis of potentially regulated mRNA targets will be useful. A short list of useful software and databases can be found below.



Software and Databases

Exiqon offers a software package tailored to suit the needs of analysis of the miRCURY LNA™ microRNA Arrays. The easy-to-use software package includes ImaGene® 9 for image analysis and Nexus Expression™ 2 for array data analysis. Together with the Exiqon specific settings file and the Exiqon quick manual, a successful array analysis can be obtained with a few clicks. Brief descriptions of the two software tools are given below. Further information is available at www.exiqon.com/mirna-array-software.

ImaGene

The Exiqon-offered image analysis software ImaGene® 9 places a grid on top of the scanned array image, and identifies which probe is located in each spot. The software quantifies the signal intensity and the surrounding background. ImaGene® 9 can also be used for basic data normalization. ImaGene in our hands outperforms other software regarding precision in spot recognition and flagging.

Nexus Expression

Nexus Expression™ 2 is the miRCURY LNA™ microRNA Array supportive software for statistical analysis of array profiling data. Nexus Expression™ 2 is fully compatible with ImaGene® but also other common image analysis program output formats are supported. Nexus Expression™ 2 allows background subtraction, normalization and visualization of array data. It can combine the replicated measures of each probe on the arrays into one output value per array and make statistical calculations of the differentially expressed data obtained by comparing the microRNA signal data of different array experiments. The active links of the probe-target information to miRBase allows for easy retrieval of further microRNA information. Additional information can be found on the Exiqon website at www.exiqon.com/mirna-array-software.

Several other commercial and free software packages for microarray image and data analysis are also available. A selection of these is listed below. The list is not complete and a more appropriate solution may be available for certain projects. For a more comprehensive overview of software packages, it is advised to visit statweb at www.statsci.org/micrarra/index.html.



Links to other array software:**Image analysis:**

Bzscan <http://tagc.univ-mrs.fr/ComputationalBiology/bzscan/>
ScanAlyze <http://rana.lbl.gov/EisenSoftware.htm>
Spotfinder <http://www.tm4.org/spotfinder.html>

Statistical analysis:

Carmaweb <https://carmaweb.genome.tugraz.at/>
DChip <https://sites.google.com/site/dchipsoft/downloading-dchip-software>
Midas <http://www.tm4.org/midas.html>
R/bioconductor /
limma <http://www.r-project.org/>
<http://www.bioconductor.org/> <http://bioinf.wehi.edu.au/limma/>

Links to additional array analysis software and microRNA software and databases in general are available at www.exiqon.com/array



Tips and Trouble Shooting

Experimental procedure

39

Tip 1

Preparation of RNA sample

Total RNA should be prepared using a method that retains small RNA species. When using commercially available kits, please ensure that the total RNA preparation is guaranteed to contain microRNAs.

We recommend using our miRCURY™ RNA Isolation Kits for total RNA purification. Procedures that include acidic phenol chloroform extraction are generally also recognized as methods that preserve small RNAs. However, we recommend a column purification step following the phenol:chloroform extraction to remove any trace of these chemicals, as they could potentially inhibit the labeling reaction. Our miRCURY™ RNA Isolation Kits can be used for this procedure.

The purified total RNA should be dissolved in RNase-free water or TE buffer at a concentration of no more than 2 µg/µL. It is recommended to assess the integrity of the RNA isolated before proceeding with labeling. This may be performed either on the Agilent Bioanalyzer (RIN values should be above 7) or by denaturing gel electrophoresis. Degraded RNA is generally not suitable for labeling or for hybridization to microarrays. However, RNA extracted from FFPE samples does give good results on miRCURY LNA arrays. The miRCURY LNA™ microRNA Hi-Power Labeling Kit can be used for efficient labeling of both microRNA enriched and total RNA. However, microRNAs constitute only a small fraction (~0.01%) of the total RNA. Attempts to purify this small fraction can result in loss of microRNAs or co-purification of larger RNA species. For this reason, we recommend using total RNA for labeling and hybridization.

The amount of total RNA to be labeled for an array hybridization depends on the microRNA content of the cells or tissue being analyzed. Without prior knowledge of the microRNA content we recommend using between 250 ng and 1 µg of total RNA per labeling reaction.



Tip 2

Black spots - purification of the labeling reaction I

Ghost spots can be avoided by removing unincorporated dye. We recommend that the labeled RNA is purified using miRCURY™ RNA Isolation Kit or an exclusion column e.g. Roche mini Quick Spin™ OLIGO columns or BioRad Micro Bio-Spin columns. Alternatively, perform the ethanol precipitation shown below:

- Mix the Hy3™ and Hy5™ labeling reactions before precipitation.
- Add 2.5µL RNase free Sodium acetate (3M, pH5.5) to the 25µL labeling reaction and 75µL 99.9% ethanol.
- Incubate the sample at -20° C for 30 minutes.
- Centrifuge 30 minutes at max speed in a cooled centrifuge.
- Remove supernatant and wash with 80% precooled ethanol, by centrifuging 5 min at max speed in a cooled centrifuge.
- Remove supernatant and if necessary speedvac for a few minutes to remove remainder of ethanol.
- Dissolve in a mixture of 4µL DMSO, 15µL water and 6µL labeling buffer.

Tip 3

Concentration and purification of the labeling reaction II

We recommend that you follow the standard instruction manual for the labeling reaction, which will yield 50 µL (if running dual color). To minimize the number of handling steps through which the concentration of microRNAs may be compromised, we recommend loading 45 µL of the sample into the NimbleGen HX1 mixer without a concentration/purification step; However if high fluorescent background is repeatedly observed, you may purify the labeling reactions to remove unincorporated dyes. For purification and/or concentration of the sample we recommend miRCURY™ RNA Isolation Kits, alternatively either ethanol precipitation or the RNeasy Mini Kit. Due to the bleaching effect of ozone on Hy5™ it is important to finish the concentration of the labeling reaction in the shortest amount of time possible.

Ethanol precipitation:

The combined labeling reaction can be concentrated by either ethanol precipitation as shown below, or as described in Tip 1:

- Add 1/10 vol RNase free sodium acetate (3M, PH 5.5) to the 25 µl labeling reaction + 3 vol 100% ethanol



- Incubate the sample at -20°C for 20 minutes
- Centrifuge 20 minutes at $> 12000\text{g}$ at 4°C
- Remove supernatant and wash the pellet with $200\ \mu\text{l}$ 80% precooled ethanol (-20°C)
- Centrifuge 5 minutes at $> 12000\text{g}$ at 4°C
- Remove supernatant and let the pellet dry for 5 minutes
- Dissolve in a mixture of $20\ \mu\text{l}$: $3.2\ \mu\text{l}$ DMSO, $12\ \mu\text{l}$ H₂O and $4.8\ \mu\text{l}$ labeling buffer

miRCURY™ RNA Isolation Kits

- Please refer to the miRCURY™ RNA Isolation Kit manual for an RNA concentration protocol.

Tip 4

Solid particles

If you are concerned about introducing microscopic solid particles onto your array, then filter the sample through a Millipore 0.22 Ultrafree-MC Centrifugal Filter (product # UFC30GV0S): Wet the filter with $20\ \mu\text{L}$ Nuclease-free water, spin 1 min. at $12,000\ \text{rpm}$ and remove water. Add the target preparation and repeat the centrifugation. The flow-through contains the labeled sample(s).

Tip 5

Flushing the hybridization chamber

In order not to lose any target when using automated hybridization stations, it is recommended that you inject a volume smaller than the total volume of the hybridization chamber. The mixing mechanism of the hybridization station will ensure that the injected sample will be distributed equally across the entire array. To ensure that the composition of the hybridization buffer is the same after mixing it is recommended to flush the hybridization chamber with 1X hybridization buffer immediately prior to sample injection.

Tip 6

Dry slides

If you are doing manual hybridization and have more than 2 slides in your experiment you can dry the slides in a centrifuge by placing the slides in a slide rack on a swinging plate tray ($1,000\ \text{rpm}$ for 5 minutes). Alternatively, place your slides back to back in a screw-top tube and spin at $1,000\ \text{rpm}$ for 5 minutes in a centrifuge.



Tip 7

No signals

Check that the Hy3™ labeled “landing lights” are visible. They are located in all 4 corners plus one extra in the lower right corner of the 48 sub-arrays, 240 total. If they are visible, please check that signals from the spike-in controls used in the labeling can be seen. If not, the labeling procedure probably has failed. If the spike-in controls can be seen, please check that your total RNA sample is of good quality by gel electrophoresis and optical density analysis. If the RNA quality is good, then try to increase the amount of RNA used in the labeling.

If signals in the Hy5™ channel are unexpectedly low, it could be due to high ozone levels in the air. Ozone has a bleaching effect on the Hy5™. Exiqon recommends to perform labeling reaction, slide handling and scanning in an ozone free environment.

Tip 8

High signals

Due to high binding affinity of the LNA™-enriched miRCURY™ capture probes, it is of utmost importance to use high stringency experimental settings, i.e. using the miRCURY LNA™ microRNA Array hybridization buffer and an overnight hybridization temperature of 56° C. Furthermore, use of ½-1 µg total RNA will in most cases result in optimal array signal intensities.

Tip 9

High background

Using a manual hybridization procedure with cover slip may produce high background around the margins of the coverslip. This is usually caused by evaporation of the hybridization solution. To avoid uneven distribution of the hybridization solution, it is important to position the slide horizontally. To increase the humidity, we recommend using a water bath.



Spike-in miRNA signal distribution

Tip 10

Sample signal distribution for Spike-in miRNA Kit v2 [product # 208041]

Figure 3 below shows the distribution of the 52 spike-in microRNAs spiked into 0.25 µg universal reference RNA (Ambion, AM6000). The concentration of the various spike-in microRNAs are optimized such that the signal intensities of these spike-in microRNAs are in the dynamic range of naturally expressed microRNAs in most tissues.

Figure 3

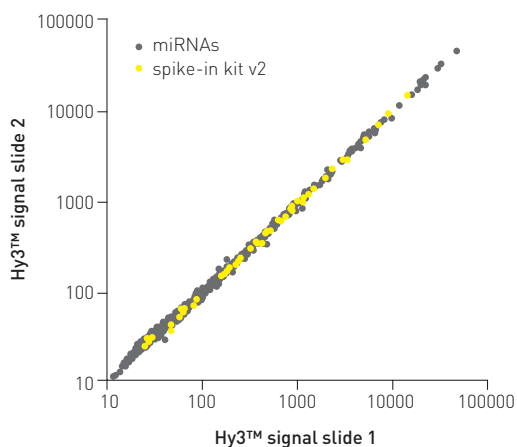


Figure 3. Scatter plot of two hybridizations with spike-in miRNA kit v2 added. One µL of the Spike-in microRNA kit v2 was spiked into each sample of 0.25 µg total RNA from a mix of human tissues and labeled with Hy3™. Labeling was performed using the miRCURY LNA™ microRNA Power Labeling Kit. Hybridization was performed using the Tecan HS4800™ Pro hybridization station.



Sample signal distribution for Spike-in miRNA Kit (product # 208040)

Figure 4 below shows the distribution of the 10 spike-in microRNAs spiked into 1 μg of total RNA from human lung samples. The concentration of the various spike-in microRNAs are optimized so the signal intensities of these spike-in microRNAs are in the dynamic range of naturally expressed microRNAs in most tissues.

Figure 4

The position of signals from the spike-in microRNA set compared to signals from microRNAs will depend upon the microRNA expression level in the sample.

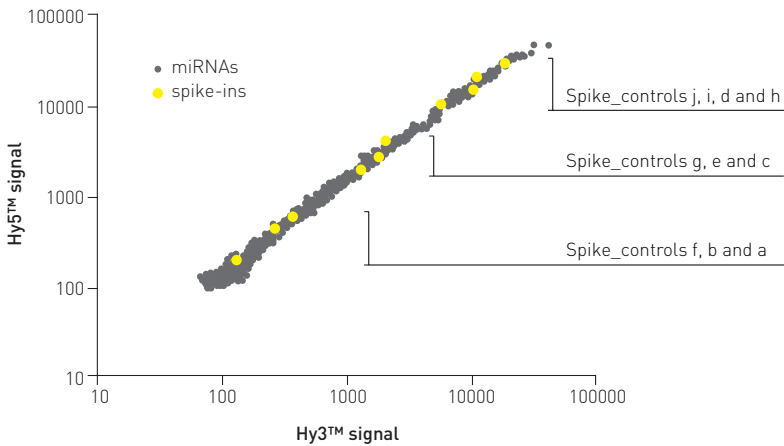


Figure 4. Scatter plot of a self-self hybridization with spike-in mix. One μL of the Spike-in miRNA kit was spiked into a sample of 1 μg total RNA from human lung labeled with Hy3[™]. Another 1 μL of spike-in microRNAs were spiked into 1 μg RNA from human lung and labeled with Hy5[™]. Labeling was performed using the miRCURY LNA[™] microRNA Power Labeling Kit. Hybridization was performed using the Tecan HS4800[™] Pro hybridization station.

References

- The microRNA Registry.
Griffiths-Jones S. *Nucleic Acid Research*, 2004, 32, Database Issue, D109-11
- miRBase, <http://www.mirbase.org>
- www.exiqon.com/array



Related Products

Exiqon offers a range of tools designed for microRNA isolation, expression analysis, localization and functional analysis.

Figure 5



miRCURY™ RNA Isolation Kits

Get high quality total RNA suitable for miRCURY LNA™ microRNA Array analysis in as little as 20 minutes. Protocols are available for a large number of sample types and organisms.

miRCURY LNA™ microRNA Hi-Power Labeling Kit

For fluorescent labeling of microRNAs from total RNA samples ready for array hybridization (product # 208033, 208034, 208035).

miRCURY LNA™ microRNA Array, ready-to-spot probe set

Ready-to-spot oligo for direct printing of arrays, or coupling in bead-based applications (product # 208410-A).

miRCURY LNA™ microRNA Array, Spike-in miRNA kit

Ten different synthetic unlabeled microRNAs in different concentrations. The spike-in microRNA kit will hybridize to corresponding capture probes on the miRCURY LNA™ microRNA Array (product # 208040).

miRCURY LNA™ microRNA Array, Spike-in miRNA kit v2

52 different synthetic unlabeled microRNAs in different concentrations. The microRNAs will hybridize capture probes on the miRCURY LNA™ microRNA Array (product # 208041).



miRCURY LNA™ microRNA Array, Hybridization buffer

5 mL hybridization buffer optimal for microRNA hybridization to the miRCURY LNA™ microRNA Arrays [product # 208022].

miRCURY LNA™ microRNA Array, Wash buffer kit

125 mL salt buffer and 15 mL detergent optimal for wash of miRCURY LNA™ microRNA Arrays. [product # 208021].

miRCURY LNA™ microRNA Detection

For *in situ* hybridization and northern blotting of all annotated microRNAs. miRCURY LNA™ microRNA ISH Buffer Set (FFPE).

miRCURY LNA™ microRNA ISH Optimization kit (FFPE)

Complete kit with control probes and hybridization buffer for easy set up of microRNA in situ hybridization.

miRCURY LNA™ microRNA Inhibitors and Power Inhibitors

Unravel the function of microRNAs by microRNA inhibition. Sophisticated LNA™ design ensures potent inhibition of all microRNAs regardless of their GC content. Chemically modified, highly stable Power Inhibitors for unrivalled potency.

miRCURY LNA™ microRNA Inhibitor Library

For genome-wide high throughput screening of microRNA function.

miRCURY LNA™ Universal RT microRNA PCR

Exiqons microRNA qPCR system offers the best available combination of performance and ease-of-use on the microRNA real-time PCR market. The combination of a Universal RT reaction and LNA™-enhanced PCR primers results in unmatched sensitivity and specificity. The Ready-to-use microRNA PCR panels enable fast and easy microRNA expression profiling.



Literature citations:

Please refer to miRCURY LNA™ microRNA Array when describing a procedure for publication using this product.

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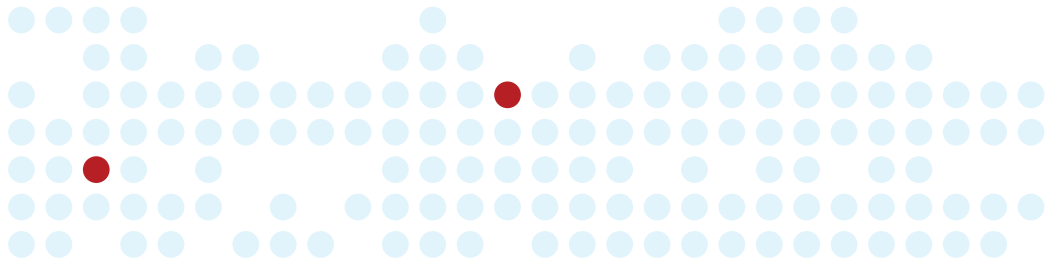
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