



# TargetAmp™ 1-Round Biotin-aRNA Amplification Kit 104

**Cat. No. TAB1R6910 – 10 Reactions**  
**Cat. No. TAB1R6924 – 24 Reactions**

## LIMITED LABEL LICENSE

This product is covered by intellectual property licensed to EPICENTRE from Johnson & Johnson Pharmaceutical Research & Development, L.L.C.

This product is covered by U.S. Patents licensed exclusively to Incyte Corporation and sublicensed to EPICENTRE. The purchase of this product conveys to the buyer the limited, non-exclusive, non-transferable right (without the right to resell, repackage or further sublicense) under those patents to perform the RNA amplification methods claimed in those patents for research and development purposes, including clinical development of pharmaceutical and diagnostic products and services, solely in conjunction with this product. No other license is granted to the buyer whether expressly, by implication, by estoppel or otherwise. In particular, no rights are conveyed to the buyer to use the product or components of the product for purposes including but not limited to provision of services to a third party, generation of commercial databases or clinical diagnostics. This product is sold pursuant to authorization from Incyte Corporation and Incyte Corporation reserves all other rights under these patents. For information on purchasing a license to the patents of Incyte Corporation for uses other than in conjunction with this product or to use this product for purposes other than research, please contact Incyte Corporation Licensing, Experimental Station, Building 336, Route 141 and Henry Clay Road, Wilmington, DE 19880. Phone 302-498-6700.

For Research Use Only.

*-continued*  
*Lit. #260*

---

<b>Table of Contents</b>	<b>Page</b>
KIT CONTENTS	3
Storage	3
Additionally Required Reagents and Equipment	3
Performance Specifications and Quality Control	3
INTRODUCTION	4
Features and Benefits of the TargetAmp 1-Round Biotin-aRNA Amplification Kit 104	4
First-strand cDNA Synthesis	4
Second-strand cDNA Synthesis	4
<i>In Vitro</i> Transcription of Biotin-aRNA	4
Reference	5
Figure 1 TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 Procedure	5
PREPARATION	6
Assessing the Quality of the Total RNA	6-7
Maintaining an RNase-free Environment	7
Input Total RNA and Biotin-aRNA Yield	8
Producing Biotin-aRNA containing both Biotin-UMP and Biotin-CMP	9
Additional Suggestions	9
RNA AMPLIFICATION PROCEDURE	10
First-strand cDNA Synthesis	10-11
Second-strand cDNA Synthesis	11
<i>In Vitro</i> Transcription of Biotin-aRNA	12
Biotin-aRNA Purification	13
Quantifying the Concentration, Yield and Fold-Amplification of the Biotin-aRNA	14
Assessing the Size of the Biotin-aRNA Produced	15
Abbreviated Protocol	16
APPENDIX 1	
The TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 Control Reaction	17
ADDITIONAL TARGETAMP aRNA AMPLIFICATION KITS & SELECTION GUIDE	18
RELATED PRODUCTS	19

**KIT CONTENTS**

**Storage**

**Additionally Required Reagents and Equipment**

**Performance Specifications and Quality Control**

The kit components are supplied in tubes with colored caps for easier identification.

The kit has been developed for use with and will provide optimal results with **SuperScript™ III Reverse Transcriptase** (Invitrogen Corp.; provided by the user).

Component Name	Tube Label	10	24
		Reactions	Reactions
Red-Cap Tubes			
TargetAmp™ T7-Oligo(dT) Primer A	T7-Oligo(dT) Primer A	15 <input type="checkbox"/>	30 <input type="checkbox"/>
TargetAmp™ Reverse Transcription PreMix-SS	RT PreMix-SS	25 <input type="checkbox"/>	50 <input type="checkbox"/>
TargetAmp™ DNA Polymerase PreMix-SS 1	DNA Pol. PreMix-SS 1	60 <input type="checkbox"/>	125 <input type="checkbox"/>
TargetAmp™ DNA Polymerase-SS 1	DNA Polymerase-SS 1	10 <input type="checkbox"/>	18 <input type="checkbox"/>
Green-Cap Tubes			
TargetAmp™ T7 RNA Polymerase	T7 RNA Polymerase	50 <input type="checkbox"/>	110 <input type="checkbox"/>
TargetAmp™ T7 Transcription Buffer	T7 Transcription Buffer	50 <input type="checkbox"/>	110 <input type="checkbox"/>
100 mM ATP	ATP	50 <input type="checkbox"/>	110 <input type="checkbox"/>
100 mM CTP	CTP	50 <input type="checkbox"/>	110 <input type="checkbox"/>
100 mM GTP	GTP	50 <input type="checkbox"/>	110 <input type="checkbox"/>
UTP / Biotin-UTP	UTP / Biotin-UTP	60 <input type="checkbox"/>	140 <input type="checkbox"/>
RNase-Free DNase I	DNase I	30 <input type="checkbox"/>	55 <input type="checkbox"/>
Colorless-Cap Tubes			
100 mM Dithiothreitol (DTT)	DTT	60 <input type="checkbox"/>	125 <input type="checkbox"/>
HeLa Total RNA Control (40 ng/ <input type="checkbox"/> l)	HeLa Total RNA Control	10 <input type="checkbox"/>	10 <input type="checkbox"/>
RNase-Free Water	RNase-Free Water	500 <input type="checkbox"/>	500 <input type="checkbox"/>

**Storage:** Upon receipt of this kit, remove the tube containing the **HeLa Total RNA Control** and **store it at -70°C to -80°C**. Store the remainder of the kit at -20°C.

**Additionally Required Reagents and Equipment:**

- SuperScript III Reverse Transcriptase (Invitrogen Corp.)
- Thermocycler or water bath
- Microcentrifuge
- RNase-Free Water
- RNeasy® MinElute® Cleanup Kit (Qiagen) or RNeasy Mini Kit (Qiagen)  
(see "**aRNA Purification**" page 13 for details)
- Biotin-CTP (Optional)

**Performance Specifications and Quality Control**

The TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 is function-tested in a control reaction. The kit must produce at least 8 g of Biotin-aRNA (cRNA) from 80 ng of HeLa Total RNA Control, corresponding to a greater than 5,000-fold amplification of the Poly(A) RNA assuming that 2% of the HeLa Total RNA Control is Poly(A) RNA. A negative control reaction ("no-RNA" control) produces less than 1 g of Biotin-aRNA.

**INTRODUCTION****Features and Benefits of the TargetAmp 1-Round Biotin-aRNA Amplification Kit 104****First-strand cDNA Synthesis****Second-strand cDNA Synthesis*****In Vitro* Transcription of Biotin-aRNA****Features and Benefits of the TargetAmp 1-Round Biotin-aRNA Amplification Kit 104:**

- 1) Greater than 5,000-fold amplification of the Poly(A) RNA contained in a total RNA sample.
- 2) Produce high yields of Biotin-aRNA (cRNA) from as little as 25 ng of total RNA.
- 3) No need for post-amplification labeling of aRNA.
- 4) *In vitro* transcription reaction is readily modified to incorporate both biotin-UTP and biotin-CTP.
- 5) No need to purify the cDNA transcription template prior to the *in vitro* transcription reaction.
- 6) Utilizes an improved "Eberwine" linear RNA amplification process.
- 7) Virtually eliminates template-independent reactions.
- 8) Reproducible amplification results.
- 9) Single tube reaction.
- 10) Fast reaction times...1-round of amplification can be completed in about 6 hours.
- 11) Easy to use...color-coded tubes and a simplified pipetting scheme reduce labor and the possibility of error.

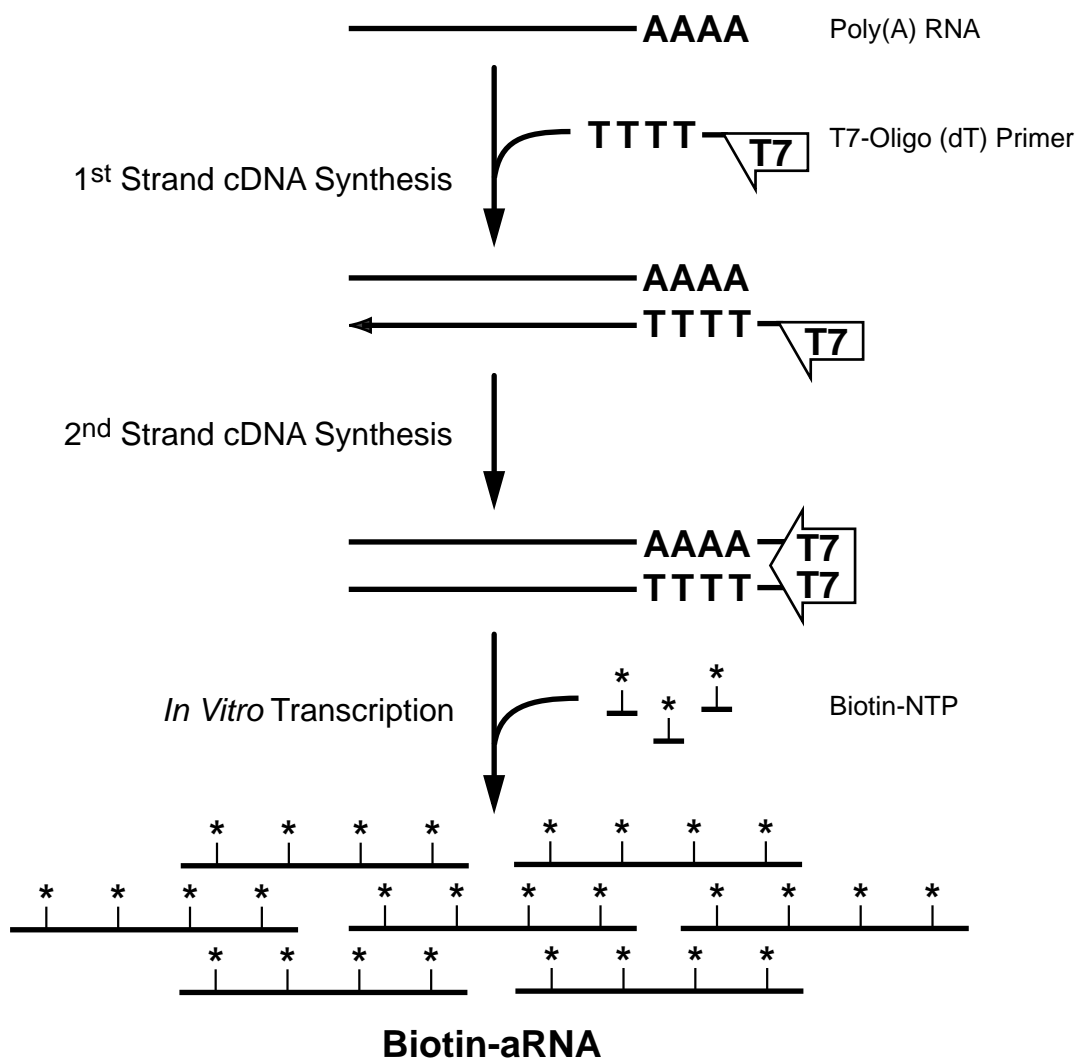
The **TargetAmp 1-Round Biotin-aRNA Amplification Kit 104** utilizes an improved "Eberwine" procedure<sup>1</sup> to produce microgram amounts of biotin-labeled aRNA (biotin-aRNA) from as little as 25 ng of total cellular RNA. The kit has been developed for use with SuperScript III Reverse Transcriptase (Invitrogen; provided by the user). The complete TargetAmp 1-Round Biotin-aRNA Amplification procedure can be completed in about 6 hours (Figure 1, page 5).

1. **First-strand cDNA Synthesis:** The Poly(A) RNA component of a total RNA sample is reverse transcribed into first strand cDNA. The reaction is primed from a synthetic oligo(dT) primer containing a phage T7 RNA Polymerase promoter sequence at its 5'-end. First strand cDNA synthesis is catalyzed by SuperScript III Reverse Transcriptase (provided by the user) and performed at an elevated temperature to reduce RNA secondary structure.
2. **Second-strand cDNA Synthesis:** The RNA component of the cDNA:RNA hybrid produced in Step 1 is digested into small RNA fragments using an RNase H enzyme. The RNA fragments then prime 2<sup>nd</sup>-strand cDNA synthesis. The resulting product is a double-stranded cDNA containing a T7 transcription promoter in an orientation that that will generate anti-sense RNA (aRNA; also called cRNA) during the subsequent *in vitro* transcription reaction. The cDNA produced can be used in the *in vitro* transcription reaction without the need for purification.
3. ***In Vitro* Transcription of Biotin-aRNA:** High yields of Biotin-aRNA (Biotin-cRNA) are produced in a rapid *in vitro* transcription reaction that utilizes the double-stranded cDNA produced in Step 2 as template. During the *in vitro* transcription reaction, Biotin-UTP replaces a portion of the UTP.

**Reference:**

1. Van Gelder, R. N. *et al.*, (1990) *Proc. Natl. Acad. Sci. USA* **87** (5), 1663.

**Figure 1. TargetAmp™ 1-Round Biotin-aRNA Amplification Kit 104 Procedure.**



**PREPARATION**

**Assessing the Quality of the Total RNA**  
**Maintaining an RNase-free Environment**  
**Input Total RNA and Biotin-aRNA Yield**  
**Producing Biotin-aRNA containing both Biotin-UMP and Biotin-CMP**  
**Additional Suggestions**

**Assessing the Quality of the Total RNA:**

The success of microarray experiments is strongly influenced by the quality of the RNA. RNA quality has two components: purity of the RNA (or absence of contaminants) and integrity (intactness) of the RNA. RNA quality should be assessed prior to every RNA amplification reaction. **Poor quality RNA is the most common cause of sub-optimal RNA amplification results!**

**RNA Purification Methods and RNA Purity.** Total cellular RNA, isolated by a number of methods, can be amplified successfully using the TargetAmp 1-Round Biotin-aRNA Amplification Kit 104. However, it is very important that the purified RNA be free of salts, metal ions, ethanol and phenol which can inhibit the enzymatic reactions performed in the RNA amplification process. Commonly used RNA extraction and purification methods that are compatible with the TargetAmp RNA amplification process include but are not limited to:

**TRIzol® / TRI Reagent®**, a homogeneous solution of the powerful denaturants guanidinium isothiocyanate and phenol, is very effective at extracting the RNA from the cells. However *all* traces of guanidinium salts and phenol must be removed from the RNA sample prior to the RNA amplification process. If you precipitate the RNA from TRIzol-extracted cells, be sure to wash the RNA pellet at least two times with cold 70-75% ethanol to remove all traces of phenol and guanidinium salts. *Air dry* the RNA pellet (do not use a vacuum centrifuge) to remove residual ethanol. Then, resuspend the RNA in RNase-Free water. If you purify the RNA from TRIzol-extracted cells by column purification methods, please read the section **“Spin Columns”** immediately following.

**Spin Columns** (e.g., the RNeasy MinElute Cleanup Kit and RNeasy Mini Kit from Qiagen) are effective in purifying RNA samples that are free of the contaminants that may inhibit the RNA amplification process. Spin columns can be used with most RNA extraction procedures (e.g. TRIzol reagent). If using spin columns, follow the manufacturer's instructions closely. Make sure to remove all washing solution prior to the RNA elution step. Then, elute the RNA from the column membrane using RNase-Free water.

**Salt-Fractionation:** RNA purification that employs gentle salt-fractionation, such as EPICENTRE's MasterPure™ RNA Purification Kit and ArrayPure™ Nano-scale RNA Purification Kit, routinely produce the highest yield of intact RNA without the use of phenol, guanidinium salts or columns. The ArrayPure kit has been developed for total RNA purification from 1-10,000 cells obtained by laser-capture methods such as Laser Capture Microdissection (LCM), from biopsy samples, from cell culture or quick-frozen tissue. To purify RNA from >10,000 cells, EPICENTRE's MasterPure RNA Purification Kit is recommended. When using these kits, be sure to wash the RNA pellet at least two times with cold 70-75% ethanol to remove all traces of salts. *Air dry* the RNA pellet (do not use a vacuum centrifuge) to remove residual ethanol. Then, resuspend the RNA in RNase-Free water. The ArrayPure kit and MasterPure kit are *not* recommended for purification of RNA from tissue samples preserved with RNA*later*® or RNA*later*-ICE.

**RNA Integrity.** Successful microarray analysis using amplified RNA is dependent on an RNA sample that contains full-length, intact Poly(A) RNA. The most commonly used methods for assaying RNA integrity are by **denaturing agarose gel electrophoresis** or using an **Agilent 2100 Bioanalyzer**.

The advantages of **denaturing agarose gel electrophoresis** are its low cost and ready availability of the reagents required. Denaturing gel electrophoresis separates the RNAs by size (electrophoretic mobility) under denaturing conditions. Denaturing conditions are necessary to eliminate inter- and intra-molecular interactions within the RNA sample which may cause abnormal electrophoretic mobility. Following electrophoresis, the denaturing gel is stained with, for example, ethidium bromide and the user looks for the highly stained 18S and 28S rRNAs. These bands should be sharp and discrete with an absence of smearing under either. Based on these visual observations, the user infers that the mRNA in the sample is equally intact (or degraded). If the rRNA bands appear degraded, as evidenced by smearing under each, the RNA sample should be discarded and a new sample of total RNA purified. Ideally, the ethidium bromide stained 28S rRNA band should appear to be about twice as intense as the 18S rRNA band. The main disadvantage of denaturing gels is that they require up to 1 µg of total RNA be loaded per lane...a quantity of RNA that often is not expendable for those performing RNA amplification.

The **Agilent 2100 Bioanalyzer** is currently the preferred method for evaluating the integrity of an RNA sample. Like a denaturing gel, the bioanalyzer separates the RNAs by size (electrophoretic mobility). However, in contrast to a denaturing gel, the 2100 Bioanalyzer requires nanogram amounts of total RNA per well when using the manufacturer's RNA 6000 Nano LabChip®. When analyzing the RNA sample using the Agilent 2100 Bioanalyzer, the 18S and 28S rRNA species should appear as distinct, sharp peaks on the electropherogram. A slightly increased baseline, indicative of the 1-5% Poly(A) RNA contained in the sample, can be seen between the two peaks.

#### **Maintaining an RNase-free Environment:**

Ribonuclease contamination is a significant concern for those performing RNA amplification. The ubiquitous RNase A is a highly stable and active ribonuclease that can contaminate any lab environment and is present on human skin. All components of the TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 have been tested to ensure the lack of contaminating ribonuclease activities. However, creating an RNase-free work environment and maintaining RNase-free solutions is critical for performing successful RNA amplification reactions. Therefore, we strongly recommend that the user:

- 1) Use RNase-free or autoclaved tubes and pipette tips
- 2) Always wear gloves when handling samples containing RNA. Change gloves frequently especially after touching potential sources of RNase contamination such as door knobs, pens, pencils and human skin.
- 3) Always wear gloves when handling kit components. Do not pick up any kit component with an ungloved hand.
- 4) Keep all kit components tightly sealed when not in use. Keep all tubes containing RNA tightly sealed during the incubation steps.

**Input Total RNA and Biotin-aRNA Yield:**

The TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 is extremely efficient at amplifying very small quantities of Poly(A) RNA in a total RNA preparation. The TargetAmp kit has been evaluated for production of Biotin-aRNA from as little as 25 ng of total RNA using the HeLa Total RNA control provided in the kit. User results may vary depending on the quality of the total RNA sample and the Poly(A) content of the sample.

**Table 1. Yields of Biotin-aRNA (Biotin-cRNA) obtained using the TargetAmp™ 1-Round Biotin-aRNA Amplification Kit 104.** Results summarize experiments performed using the HeLa Total RNA control provided in the kit.

HeLa Control total RNA	HeLa Poly(A) RNA [assume 2% of HeLa total RNA is Poly(A) RNA]	Biotin-aRNA Yield	Fold-Amplification of HeLa Poly(A) RNA [Biotin-aRNA yield / Poly(A) content]
25 ng	0.5 ng	3.1 $\mu$ g (3100 ng)	6200
50 ng	1 ng	5.3 $\mu$ g (5,300 ng)	5300
100 ng	2 ng	10.8 $\mu$ g (10,800 ng)	5600
200 ng	4 ng	22.6 $\mu$ g (22,600 ng)	5650
400 ng	8 ng	47.2 $\mu$ g (47,200 ng)	5900
500 ng	10 ng	75.6 $\mu$ g (75,600 ng)	7500

**Important!** The TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 has been optimized for producing >5,000-fold amplification of the Poly(A) RNA from 25-500 ng of total cellular RNA per reaction. Amplifying >500 ng of total RNA in a single TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 reaction may result in less than 5,000-fold amplification of the Poly(A) RNA and may result in under-representation of some Poly(A) RNA sequences in the Biotin-aRNA produced. Therefore, if it is desirable to perform an amplification reaction using >500 ng of total RNA, we *strongly* recommend that the user perform multiple reactions, each containing up to but not exceeding 500 ng of total RNA.

**Producing Biotin-aRNA containing both Biotin-UMP and Biotin-CMP:**

The standard TargetAmp 1-Round Biotin-aRNA Kit 104 reaction produces Biotin-aRNA (Biotin-cRNA) containing Biotin-UMP. Biotin-aRNA containing both Biotin-UMP and Biotin-CMP can be produced if desired by modifying the *in vitro* transcription reaction (Step C; page 12) to additionally include Biotin-CTP (supplied by the user).

**Additional Suggestions:****Familiarize Yourself with the TargetAmp Kit and Procedure:**

The TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 includes many reagents. Before starting, please read this protocol carefully and familiarize yourself with each kit component and in which step of the RNA amplification process it is used. Be sure to wear gloves when handling the kit components.

**Importance of Running the Control Reaction:**

We strongly recommend that those who are not experienced with the TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 perform a control amplification reaction (APPENDIX 1, page 17) prior to committing a precious sample. HeLa total RNA is provided with the kit as a control.

**Performing the TargetAmp 1-Round Biotin-aRNA Amplification Reactions:**

We recommend that all reactions be performed in sterile 0.2 ml or 0.5 ml thin-walled tubes using sterile pipette tips and recently calibrated pipettors. Very small volumes of some kit components are required for each reaction. Therefore, we recommend the user prepare Master Mixes of reaction components when amplifying multiple samples.

**Some Simple but Important Factors for Obtaining Optimal Results:**

- 1) Familiarize yourself with the kit by running a control reaction (APPENDIX 1, page 17) before committing a precious sample.
- 2) Use up to but not more than 500 ng of total RNA per reaction.
- 3) Assemble the *in vitro* transcription reaction (Step C) at room temperature.  
Do not exceed the *in vitro* transcription reaction time indicated in the procedure.
- 4) Optional stopping points are noted following the 2<sup>nd</sup>-strand cDNA synthesis step (Step B) and after purification of the Biotin-aRNA (Step D).

**RNA AMPLIFICATION PROCEDURE**

- First-strand cDNA Synthesis**
- Second-strand cDNA Synthesis**
- In Vitro* Transcription of Biotin-aRNA**
- Biotin-aRNA Purification**
- Quantifying the Concentration, Yield and Fold-Amplification of the Biotin-aRNA**
- Assessing the Size of the Biotin-aRNA Produced**

Please read through the TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 procedure carefully before beginning. We *strongly* recommend that those who are not experienced with the TargetAmp kit perform a control amplification reaction (APPENDIX 1, page 17) prior to committing a precious sample. A HeLa total RNA control is provided with the kit.

An abbreviated (single page) protocol is presented on page 16 for user's experienced in using this kit.

**A. First-strand cDNA Synthesis**

**SuperScript III Reverse Transcriptase** (Invitrogen) is required for use in this Step. The SuperScript III enzyme is provided by the user. The total RNA sample must be free of contaminating salts, metal ions, ethanol and phenol. For best results, the RNA sample should be dissolved in RNase-Free water.

Required in Step A

<b>Component Name</b>	<b>Tube Label</b>	<b>Cap Color</b>
TargetAmp™ T7-Oligo(dT) Primer A	T7-Oligo(dT) Primer A	Red
TargetAmp™ Reverse Transcription PreMix-SS	RT PreMix-SS	Red
Dithiothreitol	DTT	Colorless
RNase-Free Water	RNase-Free Water	Colorless

**Incubation temperatures performed in Step A:** 50°C and 65°C.

**Important! The TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 has been optimized for producing >5,000-fold amplification of the Poly(A) RNA from 25-500 ng of total cellular RNA per reaction. Amplifying >500 ng of total RNA in a single TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 reaction *may* result in less than 5,000-fold amplification of the Poly(A) RNA and *may* result in under-representation of some Poly(A) RNA sequences in the Biotin-aRNA produced. Therefore, if it is desirable to perform an amplification reaction using >500 ng of total RNA, we *strongly* recommend that the user perform multiple reactions, each containing up to but not exceeding 500 ng of total RNA.**

1. Anneal the **TargetAmp T7-Oligo(dT) Primer A** to the RNA sample. If a "no template" control reaction is performed, substitute 2  of RNase-Free Water for the Total RNA sample.
  - x  RNase-Free Water
  - x  Total RNA sample (25-500 ng)
  - 1  TargetAmp T7-Oligo(dT) Primer A
  - 3  Total reaction volume
  
2. Incubate at **65°C for 5 minutes** in a water bath or thermocycler.

3. Chill on ice for 1 minute. Centrifuge briefly in a microcentrifuge.

4. Prepare the **1<sup>st</sup>-Strand cDNA Synthesis Master Mix**.

For **each** 1<sup>st</sup>-strand cDNA synthesis reaction, combine on ice:

- 1.5  TargetAmp Reverse Transcription PreMix-SS
- 0.25  DTT
- 0.25  SuperScript III Reverse Transcriptase (200 U/)
- 2  Total reaction volume

**Important!** Be sure to use **SuperScript III Reverse Transcriptase**. Do not use the SuperScript 5X Buffer or the DTT that is provided with the enzyme.

5. Gently mix the **1<sup>st</sup>-Strand cDNA Synthesis Master Mix** and then add 2  of it to each reaction.

6. Gently mix the reactions and then incubate each at **50°C for 30 minutes** in a water bath or thermocycler. If the thermocycler has a heated lid function, heat the lid only if the temperature of the lid can be maintained at about 50°C.

**B. Second-strand cDNA Synthesis**

Required in Step B

Component Name	Tube Label	Cap Color
TargetAmp™ DNA Polymerase PreMix-SS 1	DNA Pol. PreMix-SS 1	Red
TargetAmp™ DNA Polymerase-SS 1	DNA Polymerase-SS 1	Red
<b>Incubation temperatures performed in Step B: 65°C and 80°C.</b>		

1. Prepare the **2<sup>nd</sup>-Strand cDNA Synthesis Master Mix**.

For **each** 2<sup>nd</sup>-strand cDNA synthesis reaction, combine on ice:

- 4.5  TargetAmp DNA Polymerase PreMix-SS 1
- 0.5  TargetAmp DNA Polymerase-SS 1
- 5  Total reaction volume

2. Gently mix the **2<sup>nd</sup>-Strand cDNA Synthesis Master Mix** and then add 5  of it to each reaction.

3. Gently mix the reactions and then incubate at **65°C for 10 minutes** in a water bath or thermocycler. Centrifuge briefly in a microcentrifuge.

**Important!** Be sure to incubate the reactions at **65°C**.

4. Incubate the reactions at **80°C for 3 minutes**.

Centrifuge briefly in a microcentrifuge then chill on ice.

**Note:** If desired, the reactions can now be frozen and stored overnight at -20°C.

**C. *In Vitro* Transcription of Biotin-aRNA**

The *in vitro* transcription reaction produces Biotin-aRNA by incorporating Biotin-UTP into the RNA transcripts. If desired, Biotin-CTP (provided by the user) can also be incorporated.

Required in Step C

Component Name	Tube Label	Cap Color
TargetAmp™ T7 RNA Polymerase	T7 RNA Polymerase	Green
TargetAmp™ T7 Transcription Buffer	T7 Transcription Buffer	Green
100 mM ATP	ATP	Green
100 mM CTP	CTP	Green
100 mM GTP	GTP	Green
UTP / Biotin-UTP	UTP / Biotin-UTP	Green
Dithiothreitol	DTT	Colorless
RNase-Free Water	RNase-Free Water	Colorless
RNase-Free DNase I	DNase I	Green

**Incubation temperatures performed in Step C:** 37°C and 42°C.

1. Warm the **TargetAmp T7 RNA Polymerase** to room temperature. Thaw the remaining *in vitro* transcription reagents at room temperature. If a precipitate is visible in the thawed **TargetAmp T7 Transcription Buffer**, heat the Buffer to 37°C until it dissolves. Keep the TargetAmp T7 Transcription Buffer at room temperature.
2. Thoroughly mix the thawed **TargetAmp T7 Transcription Buffer and the rNTP solutions.**

**Important!** If a precipitate is visible in the thawed TargetAmp T7 Transcription Buffer, heat the Buffer to 37°C until it dissolves. Mix the Buffer thoroughly. **Keep the Buffer at room temperature.**

3. Prepare the ***In Vitro* Transcription Master Mix.**  
For **each** *in vitro* transcription reaction, **combine, in order, at room temperature:**
  - 12  RNase-Free Water
  - 4  TargetAmp T7 Transcription Buffer
  - 5.2  UTP / Biotin-UTP
  - 3.6  ATP
  - 3.6  CTP
  - 3.6  GTP
  - 4  DTT
  - 4  TargetAmp T7 RNA Polymerase
  - 40  Total reaction volume
4. Gently mix the ***In Vitro* Transcription Master Mix** and then add **40**  of it to each reaction.
5. Gently mix the reactions and then incubate at **42°C for 4 hours** in a thermocycler. If the thermocycler has a heated lid function, heat the lid only if the temperature of the lid can be maintained at about 42°C. If the lid temperature can not be maintained at about 42°C, then perform the incubations without heating the lid.

**Important!** Do not exceed 4 hour incubation at 42°C. Optimal yield and quality (length) of Biotin-aRNA is achieved in 4 hours.

6. Add **2  of RNase-Free DNase I** to each reaction.  
Mix gently and then incubate each at **37°C for 15 minutes.**

**D. Biotin-aRNA Purification**

The purification column to use is dependent upon the expected yield of aRNA. Use the table on page 8 to estimate the yield of aRNA expected from the amount of total RNA used in each amplification reaction. Then,

If the expected yield of aRNA is <40 µg: purify the aRNA using the <b>Qiagen RNeasy MinElute Cleanup Kit</b> .	(Qiagen cat. no. 74204)
If the expected yield of aRNA is >40 µg: purify the aRNA using the <b>Qiagen RNeasy Mini Kit</b> .	(Qiagen cat. no. 74014)

Use the **RNase-Free Water** that is provided in the **MinElute Cleanup Kit** or the **RNeasy Mini Kit**. The following procedure should be used with either the MinElute Cleanup Kit or the RNeasy Mini Kit.

1. Prepare 350 µl of **RLT/β-ME Solution** for each sample. Combine the RLT/β-ME in the ratio of 1 ml of Buffer RLT (provided in the RNeasy kit) with 10 µl of β-ME (β-mercaptoethanol) as described in the RNeasy kit's handbook.
2. Prepare 650 µl of **RPE Solution** for each sample by diluting 1 volume of Buffer RPE (provided in the purification kits) with 4 volumes of 96-100% ethanol as described in the purification kit's handbook.
3. To each sample add:
  - 48 µl RNase-Free Water
  - 350 µl RLT/β-ME Solution
  - 250 µl 100% Ethanol
4. Apply each sample to the purification kit's spin column in a 2 ml collection tube. Centrifuge at >8000 x g for 15 seconds. Discard the flow-through.
5. Apply 650 µl **RPE Solution** onto the column. Centrifuge at >8000 x g for 15 seconds. Discard the flow-through.
6. Apply 650 µl 80% ethanol onto the column. Centrifuge at >8000 x g for 15 seconds. Discard the flow-through.
7. Transfer the spin column into a new collection tube. Centrifuge at full speed for 5 minutes.
8. Transfer the spin column to a 1.5 ml collection tube. Elute the aRNA:
  - If using the **MinElute Cleanup Column**, apply 20 µl of RNase-Free Water directly onto the center of the silica-gel membrane. Wait for 1 minute. Centrifuge at full speed for 1 minute.
  - If using the **RNeasy Mini Column**, apply 40 µl of RNase-Free Water directly onto the center of the silica-gel membrane. Wait for 1 minute. Centrifuge at full speed for 1 minute.
9. If using the **MinElute Cleanup Column**, apply an additional 20 µl of RNase-Free Water directly onto the center of the silica-gel membrane. Wait for 1 min. Centrifuge at full speed for 1 minute.
  - If using the **RNeasy Mini Column**, apply an additional 40 µl of RNase-Free Water directly onto the center of the silica-gel membrane. Wait for 1 minute. Centrifuge at full speed for 1 minute.This second elution step recovers 25-35% of the final yield of biotin-aRNA.

**Note:** If desired, reactions can now be quick frozen (e.g., dry ice/ethanol bath) and stored at -80°C.

**E. Quantifying the Concentration, Yield and Fold-Amplification of the Biotin-aRNA**

**Concentration and yield:** The concentration of the Biotin-aRNA can be readily determined using a NanoDrop® ND-1000 UV-Vis Spectrophotometer available from NanoDrop Technologies. Alternately, due to the high yield of Biotin-aRNA that is produced by a TargetAmp reaction, the yield and concentration of Biotin-aRNA can be determined by standard UV spectroscopy.

1. Prepare a dilution of the Biotin-aRNA into the minimum volume of water or TE Buffer (10 mM Tris-HCl [pH 7.5], 1 mM EDTA) required by the spectrophotometer cuvette that will be used.
2. Zero the spectrophotometer at 260 nm using the diluents (water or TE buffer) that was used to dilute the Biotin-aRNA sample.
3. Measure and record the absorbance of the diluted Biotin-aRNA at 260 nm ( $A_{260}$ ).
4. Calculate the concentration of the Biotin-aRNA. Use the conversion factor that an  $A_{260}$  reading of 1.0 is equal to an RNA concentration of 40  $\mu\text{g/ml}$ .

**Biotin-aRNA concentration = ( $A_{260}$  reading) x (dilution factor) x (40  $\mu\text{g/ml}$ ).**

Example: Dilution for  $A_{260}$  measurement = 1:100 with an  $A_{260}$  of the 1:100 dilution = 0.15.

Biotin-aRNA concentration = (0.15) x (100) x (40  $\mu\text{g/ml}$ ) = 600  $\mu\text{g/ml}$  = (0.6  $\mu\text{g}/\mu\text{l}$ ) Biotin-aRNA.

5. Calculate the yield of Biotin-aRNA using the formula:

**Yield of Biotin-aRNA = (Biotin-aRNA Concentration) x (Volume of Biotin-aRNA).**

Example: 50  $\mu\text{l}$  of Biotin-aRNA recovered from column, 0.6  $\mu\text{g}/\mu\text{l}$  Biotin-aRNA from in Step E 4.

Biotin-aRNA yield = (0.6  $\mu\text{g}/\mu\text{l}$ ) x (50  $\mu\text{l}$ ) = 30  $\mu\text{g}$  of Biotin-aRNA.

In this example, 1  $\mu\text{l}$  of 0.6  $\mu\text{g}/\mu\text{l}$  of Biotin-aRNA was used for the spectrophotometer reading so there are now 29.4  $\mu\text{g}$  of Biotin-aRNA remaining.

**Fold amplification:** The fold-amplification of the reaction can be calculated once the yield of the Biotin-aRNA has been determined. However, if the input RNA was **total RNA**, an accurate calculation of fold-amplification requires knowledge of the Poly(A) content of the original total RNA sample. If the Poly(A) content of the sample is not known, a commonly used assumption is that Poly(A) RNA constitutes **2%** of the RNA in a total RNA sample.

**Fold-amplification = (amount of Biotin-aRNA produced) / ([amount of total RNA input] x [Percentage of Poly(A) RNA in the total RNA sample]).**

Example: Amount of input total RNA = 200 ng, Percentage of Poly(A) RNA in the sample (assumed) = 2% (0.02), Amount of Biotin-aRNA produced = 30,000 ng (30  $\mu\text{g}$ ).

Fold-amplification = 30,000 ng / (200 ng x 0.02) = 7,500.

**F. Assessing the Size of the Biotin-aRNA Produced**

Using the HeLa Control RNA provided in the kit, a TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 reaction typically produces Biotin-aRNA with a size distribution between 200-4000 bases with an average size of about 800 bases.

**Sizing the Biotin-aRNA by denaturing gel electrophoresis:** The advantages of denaturing agarose gel electrophoresis are its relatively low cost and ready availability of the reagents required. When assessing the size distribution of the Biotin-aRNA, load at least 200 ng (SYBR® Gold detection) or at least 1 µg (ethidium bromide detection) of Biotin-aRNA into the well of a 1% formaldehyde-agarose gel. Load RNA size markers that cover the size range of approximately 200-10,000 bases.

**Sizing the Biotin-aRNA using the Agilent 2100 Bioanalyzer:** Use the appropriate molecular weight standards and follow the manufacturer's instructions.

**ABBREVIATED RNA AMPLIFICATION PROCEDURE** for user's experienced in using this kit.

**First-strand cDNA Synthesis** (per reaction)

1. Anneal the TargetAmp T7-Oligo(dT) Primer A to the RNA sample.
  - x  RNase-Free Water
  - x  Total RNA sample
  - 1  TargetAmp T7-Oligo(dT) Primer A
  - 
  - 3  Total reaction volume
  
2. Incubate at 65°C for 5 minutes, then chill on ice for 1 minute, then quick spin the sample.
  
3. Add 2  of the following 1<sup>st</sup>-Strand cDNA Synthesis Master Mix.
  - 1.5  TargetAmp Reverse Transcription PreMix-SS
  - 0.25  DTT
  - 0.25  SuperScript III Reverse Transcriptase (200 U/)
  - 
  - 2  Total reaction volume
  
4. Incubate at 50°C for 30 minutes.

**Second-strand cDNA Synthesis** (per reaction)

5. Add 5  of the following 2<sup>nd</sup>-Strand cDNA Synthesis Master Mix.
  - 4.5  TargetAmp DNA Polymerase PreMix-SS 1
  - 0.5  TargetAmp DNA Polymerase-SS 1
  - 
  - 5  Total reaction volume
  
6. Incubate at 65°C for 10 minutes, quick spin the sample, then incubate at 80°C for 3 minutes, quick spin the sample then chill on ice.

***In Vitro* Transcription of Biotin-aRNA** (per reaction)

7. Add 40  of the following *In Vitro* Transcription Master Mix.
  - 12  RNase-Free Water
  - 4  TargetAmp T7 Transcription Buffer
  - 5.2  UTP / Biotin-UTP
  - 3.6  ATP
  - 3.6  CTP
  - 3.6  GTP
  - 4  DTT
  - 4  TargetAmp T7 RNA Polymerase
  - 
  - 40  Total reaction volume
  
8. Incubate at 42°C for 4 hours.
  
9. Add 2  of RNase-Free DNase I, incubate at 37°C for 15 minutes.

**Biotin-aRNA Purification**

See Section D, page 13.

**APPENDIX 1 The TargetAmp 1-Round Biotin-aRNA Amplification Kit 104 Control Reaction**

The TargetAmp kit provides 400 ng of total human HeLa RNA at a concentration of 40 ng/μl.

Required for the TargetAmp Control Reaction

<b>Component Name</b>	<b>Tube Label</b>	<b>Tube Color</b>
HeLa Total RNA Control (40 ng/μl)	HeLa Total RNA	Colorless
TargetAmp™ T7-Oligo(dT) Primer A	T7-Oligo(dT) Primer A	Red
RNase-Free Water	RNase-Free Water	Colorless

1. Thaw the **HeLa Total RNA Control** on ice.
2. Anneal the **TargetAmp T7-Oligo(dT) Primer A** to the **HeLa Total RNA Control**.  
The standard control reaction utilizes 80 ng of the HeLa Total RNA Control.  
If using less Control RNA, make up the volume of the annealing reaction with RNase-Free Water.
  - 2 μl HeLa Total RNA Control (80 ng)
  - 1 μl TargetAmp T7-Oligo(dT) Primer A
  - 3 μl Total reaction volume
3. Incubate the reaction at **65°C for 5 minutes** in a water bath or thermocycler. While the reaction incubates, quick-freeze the HeLa Total RNA Control (40 ng/μl; for example in a dry ice/ethanol bath) and return it to -70°C to -80°C storage.
4. Cool the annealing reaction on ice for at least 1 minute. Centrifuge the tube for 5-10 seconds to bring the sample to the bottom of the tube.
5. Continue the Control Reaction as described beginning in Step A4 on page 11.

**ADDITIONAL TARGETAMP aRNA AMPLIFICATION KITS & SELECTION GUIDE**

**TargetAmp™ 1-Round Aminoallyl-aRNA Amplification Kit 101**

TAA1R4910.....10 Reactions      TAA1R4924..... 24 Reactions

This kit will amplify Poly(A) RNA by **>5,000 fold** from as little as **25 ng** of total cellular RNA. The kit produces aminoallyl-aRNA and is optimized for use of SuperScript III Reverse Transcriptase (provided by the user).

**TargetAmp™ 1-Round aRNA Amplification Kit 103**

TAU1R5110.....10 Reactions      TAU1R5124..... 24 Reactions

This kit will amplify Poly(A) RNA by **>5,000 fold** producing microgram amounts of unlabeled aRNA from as little as **25 ng** of total cellular RNA. The kit is optimized for use with SuperScript III Reverse Transcriptase (provided by the user).

**TargetAmp™ 2-Round Aminoallyl-aRNA Amplification Kit 1.0**

TAA2R4910.....10 Reactions      TAA2R4924..... 24 Reactions

This kit will amplify Poly(A) RNA by **>5,000,000 fold** producing microgram amounts of aminoallyl-aRNA from as little as **10 pg** of total cellular RNA. The kit is optimized for use with SuperScript III and SuperScript II Reverse Transcriptases (provided by the user).

**TargetAmp™ 2-Round aRNA Amplification Kit 2.0**

TAU2R5110.....10 Reactions      TAU2R51224.....24 Reactions

This kit will amplify Poly(A) RNA by **>5,000,000 fold** producing microgram amounts of unlabeled aRNA from as little as **10 pg** of total cellular RNA. The kit is optimized for use with SuperScript III and SuperScript II Reverse Transcriptases (provided by the user).

	TargetAmp™ 1-Round Aminoallyl-aRNA Amplification Kit 101	TargetAmp™ 1-Round aRNA Amplification Kit 103	TargetAmp™ 2-Round Aminoallyl-aRNA Amplification Kit 1.0	TargetAmp™ 2-Round aRNA Amplification Kit 2.0
Starting Total RNA	25-500 ng	25-500 ng	10-500 pg	10-500 pg
Reverse Transcriptase(s) Used	SuperScript™ III (provided by the user)	SuperScript™ III (provided by the user)	SuperScript™ III & SuperScript™ II (provided by the user)	SuperScript™ III & SuperScript™ II (provided by the user)
Fold Amplification	>5000	>5,000	>5,000,000	>5,000,000
Time Required	1 Day	1 Day	2 Days	2 Days
End Product	Aminoallyl-aRNA	aRNA	Aminoallyl-aRNA	aRNA

---

**RELATED PRODUCTS****Kits for Isolating Total Cellular RNA and mRNA****ArrayPure™ Nano-scale RNA Purification Kit**

MPS04050 .....50 Purifications

The ArrayPure Kit provides all reagents needed to purify total RNA from 1-10,000 eukaryotic cells without the use of organic solvents such as phenol or columns.

**MasterPure™ RNA Purification Kit**

MCR85102 .....100 Purifications

The MasterPure RNA Purification Kit provides all reagents needed to purify total RNA from >10,000 eukaryotic cells without the use of organic solvents such as phenol or columns.

**mRNA-ONLY™ Eukaryotic mRNA Isolation Kit**

MOE51010 .....10 Purifications    MOE51024 ..... 24 Purifications

The mRNA-Only Eukaryotic mRNA Isolation Kit provides simple and effective isolation of eukaryotic mRNA that is substantially free of ribosomal RNA in 1 hour. The kit does not use oligo(dT), columns or resins.

**mRNA-ONLY™ Prokaryotic mRNA Isolation Kit**

MOP51010 .....10 Purifications    MOP51024 ..... 24 Purifications

The mRNA-Only Prokaryotic mRNA Isolation Kit provides simple and effective isolation of prokaryotic mRNA that is substantially free of ribosomal RNA in 1 hour.

**RNA Labeling Reagents****Biotin-X-X-NHS**

BXX51005 .....5 x 2.5 mg vials    BXX51010 ..... 10 x 2.5 mg vials

Biotin-X-X-NHS can be used to rapidly and cost-effectively label aminoallyl-aRNA and aminoallyl-DNA with biotin for use in DNA microarrays or other biotin-probe applications.

**Aminoallyl-UTP**AAU5202 .....2.5  $\mu$ moles @ 50 mM

Aminoallyl-UTP is supplied in a convenient 50 mM solution.

*TargetAmp*, *MasterPure*, *ArrayPure* and *mRNA-ONLY* are trademarks of EPICENTRE, Madison, Wisconsin.

*SYBR* is a registered trademark of, and *SuperScript* is a trademark of Invitrogen Corp., Carlsbad, California.

*MinElute* and *RNeasy* are registered trademarks of Qiagen Inc., Valencia, California.

*TRIZol* and *TRI Reagent* are registered trademarks of Molecular Research Center Inc., Cincinnati, Ohio.

*RNAlater* is a registered trademark of Ambion Inc., Austin, Texas.

*LabChip* is a registered trademark of Caliper Technologies Corp., Hopkinton, Massachusetts.

*NanoDrop* is a registered trademark of NanoDrop Technologies Inc., Wilmington, Delaware.