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Product Manual

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Total RNA Miniprep Kit

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Introduction

The Gene Choice® Total RNA Miniprep kit provides a rapid and easy method for RNA isolation from a small amount of cultured eukaryotic cells or tissues. This kit allows single or simultaneous processing of multiple samples in less than 40 minutes. Normally, 1 x 10^7 eukaryotic cells or 25-30 mg tissue can be used in a single experiment. There is no need for phenol/chloroform extractions, and time-consuming steps such as CsCl gradient ultra-centrifugation, and precipitation with isopropanol or LiCl, are eliminated. RNA purified using the kit is ready for applications such as RT-PCR, RT-qPCR, Northern blotting, poly A+ RNA (mRNA) purification, nuclease protection, and in vitro translation.

The Gene Choice® Total RNA Miniprep kit uses the reversible binding properties of a silica-based material matrix. This is combined with the speed of mini-column spin technology. A specifically formulated high salt buffer system allows 100 µg RNA fragments greater than 200 bases to bind to the matrix. Cells or tissues are lysed under denaturing conditions that inactivates RNase. After the homogenization process by either bead milling or rotor-stator homogenizer, samples are transferred to an RNA Homogenizer Mini Column to remove genomic DNA, and the filtrate is transferred to a RNA Mini Column. After a few quick washing steps in which cellular debris and other contaminants are effectively washed away, high-quality RNA is eluted in Nuclease-free water.

Kit Contents

Product	SMP96-327	96-327	96-327B
Preparations	5	50	200
RNA Mini Columns	5	50	200
RNA Homogenizer Mini Columns	5	50	200
2 mL Collection Tubes	10	100	400
RNA Lysis Buffer	5 ml	40 ml	150 ml
RNA Wash Buffer I	5 ml	50 ml	200 ml
RNA Wash Buffer II	5 ml	12 ml	50 ml
Nuclease-free Water	2 ml	15 ml	60 ml
User Manual	✓	✓	✓

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Centrifugation Protocol

Add GTC Lysis Buffer and Lyse

Transfer Lysate to RNA Homogenizer Mini Column

Add Ethanol Apply Sample to Column

Wash 3X

Dry

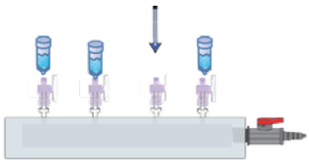
Elute

Vacuum Protocol

Add GTC Lysis Buffer and Lyse

Transfer Lysate to RNA Homogenizer Mini Column

Add Ethanol Apply Sample to Column



Wash 3X

Dry

Elute

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Storage and Stability

All kit components are guaranteed for at least 12 months from the date of purchase when stored at room temperature. During shipment, crystals or precipitation may form in the RNA Lysis Buffer. Dissolve by warming buffer to 37°C.

Important Notes

Please take a few minutes to read this booklet in its entirety to become familiar with the procedures. Prepare all materials required before starting to minimize RNA degradation.

- Whenever working with RNA, always wear gloves to minimize RNase contamination. Use only clean RNase-free disposable plastic pipette tips when using the supplied reagents
- Equilibrate samples and reagents to room temperature before beginning this protocol. All steps should be carried out at room temperature unless otherwise noted. Work quickly, but carefully
- Prepare all materials required before starting the procedure to minimize RNA degradation
- Carefully apply the sample or solution to the center of the RNA Mini Columns. Avoid touching the membrane with pipet tips

Guidelines for Vacuum Manifold

The following is required for use with the Vacuum/Spin Protocol:

A) **Vacuum Manifold**
Compatible Vacuum Manifolds: Qiagen QIAvac24, Sigma AldrichVM20, Promega Vacman®, or manifold with standard Luer connector

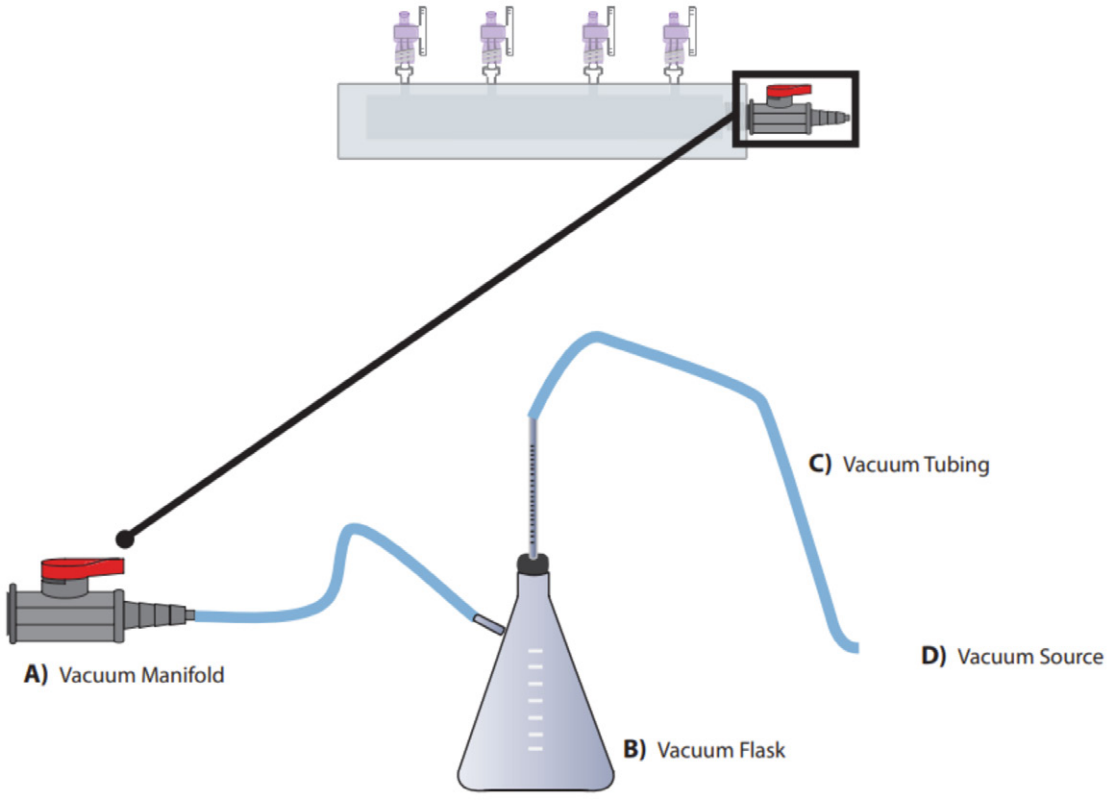
B) **Vacuum Flask**

C) **Vacuum Tubing**

D) **Vacuum Source** (review tables below for pressure settings)

Conversion from millibars:	Multiply by:
Millimeters of mercury (mmHg)	0.75
Kilopascals (kPa)	0.1
Inches of mercury (inch Hg)	0.0295
Torrs (Torr)	0.75
Atmospheres (atmos)	0.000987
Pounds Per Square Inch (psi)	0.0145

Vacuum Setup:



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Quantification of RNA

To determine the concentration and purity of RNA, measure absorbance at 260 nm and 280 nm with a spectrophotometer. One OD unit measured at 260 nm corresponds to 40 µg/ml RNA. Nuclease-free Water is slightly acidic and can dramatically lower absorbance values. We suggest that you dilute the sample in a buffered solution (TE) for spectrophotometric analysis. The A_{260}/A_{280} ratio of pure nucleic acids is 2.0, while an A_{260}/A_{280} ratio of 0.6 denotes pure protein. A ratio of 1.8-2.0 corresponds to 90%-100% pure nucleic acid. Phenol has a maximum absorbance at 270 nm and can interfere with spectrophotometric analysis of DNA or RNA. Store RNA samples at -70°C in water. Under these conditions, RNA is stable for more than a year.

Integrity of RNA

It is highly recommended that RNA quality be determined prior to beginning all downstream applications. The quality of RNA can be best assessed by denaturing agarose gel electrophoresis with ethidium bromide staining. The ribosomal RNA bands should appear as sharp, clear bands on the gel. The 28S band should appear to be double that of the 18S RNA band (23S and 16S if using bacteria). If the ribosomal RNA bands in any given lane are not sharp and appear to be smeared towards the smaller sized RNA, it is very likely that the RNA undergone degradation during the isolation, handling, or storage procedure. Although RNA molecules less than 200 bases in length do not efficiently bind to the matrix, a third RNA band, the tRNA band, may be visible when a large number of cells are used.

Preparing Reagents

1. Dilute RNA Wash Buffer II with 100% ethanol as follows and store at room temperature

Kit	100% Ethanol to be Added
SMP96-327	20 ml
96-327	48 ml
96-327B	200 ml

2. Add 20 µl 2-mercaptoethanol (β-mercaptoethanol) per 1 ml RNA Lysis Buffer. This mixture can be stored for 4 weeks at room temperature.

Disruption Techniques for Tissue Samples

Efficient sample disruption and homogenization is essential for successful total RNA isolation. Cell wall and plasma membrane disruption is necessary for the release of RNA from the sample and homogenization is necessary to reduce the viscosity of the lysates. Homogenization shears genomic DNA and other high-molecular-weight cell components creating a homogeneous lysate. Incomplete homogenization can cause the RNA Mini Column to clog resulting in low or no yield.

Rotor-Stator Homogenizer

Using a rotor-stator homogenizer for sample disruption can simultaneously disrupt and homogenize most samples. The process usually takes less than a minute depending on sample type. Many rotor-stator homogenizers operate with differently sized probes or generators that allow sample processing in 50 ml tubes.

Bead Milling

By using bead milling, cells and tissue can be disrupted by rapid agitation in the presence of glass beads and a lysis buffer. The optimal size of glass beads to use for RNA isolation are 0.5 mm for yeast/unicellular cells and 3-6 mm for animal tissue samples.

Animal Cell Protocol

All centrifugation steps used are performed at room temperature.

Materials and Equipment to be Supplied by User:

- Microcentrifuge capable of at least 14,000 x *g*
- Vortexer
- RNase-free pipette tips
- RNase-free 1.5 ml microcentrifuge tubes
- 100% ethanol
- 70% ethanol in sterile DEPC-treated water
- 2-mercaptoethanol (β-mercaptoethanol)
- Disruption equipment
    - Glass beads
    - Rotor-stator homogenizer

Before Starting:

Prepare RNA Lysis Buffer and RNA Wash Buffer II according to the "Preparing Reagents" section.

1. Determine the proper amount of starting material

Note: It is critical to use the correct amount of cultured cells in order to obtain optimal yield and purity with the RNA Mini Column. The maximum amount of cells that can be processed with the Total RNA protocol is dependent on the cell line and its RNA content. The maximum binding capacity of the RNA Mini Column is 100 µg. The maximum number of cells that RNA Lysis Buffer can efficiently lyse is 1 x 10^7. Use the following table as a guideline to select the correct amount of starting material. If no information regarding your starting material is available, begin with 1 x 10^6 cells. Based on RNA yield and quality obtained from 1 x 10^6 cells, the starting amount can be adjusted for the next purification.

Source	Number of Cells	RNA Yield (µg)
IC21	1 x 10^6	12
HeLa	1 x 10^6	15
293HEK	1 x 10^6	10
HIN3T3	1 x 10^6	15

2. Harvest cells using one of the following methods. Do not use more than 1 x 10^7 cells

For cells grown in suspension:

- Determine the number of cells
- Centrifuge at 500 x *g* for 5 minutes
- Aspirate and discard the supernatant
- Proceed to **Step 3** on **Page 11**

For cells grown in a monolayer:

Note: These cells can either be lysed directly in the cell culture dish or trypsinized and collected as a cell pellet prior to lysis. Cells grown in cell culture flasks should always be trypsinized.

For direct cell lysis:

- Determine the number of cells
- Aspirate and discard the cell culture medium
- Immediately proceed to **Step 3 on the next page** "Disrupt cells" **Note:** Incomplete removal of the cell-culture medium will inhibit lysis and dilute the lysate. This will affect the RNA binding conditions of the RNA Mini Column and may reduce RNA yield

To trypsinize and collect cells:

- Determine the number of cells
- Aspirate and discard the cell-culture medium and wash the cells with PBS

Note: Incomplete removal of the cell-culture medium will inhibit trypsin. Multiple washes may be necessary for cells that are difficult to detach.

- Add 0.1-0.25% Trypsin in a balanced salt solution
- Incubate for 3-5 minutes to allow cells to detach. Check cells for detachment before proceeding to the next step
- Add an equal volume of cell-culture medium containing serum to inactivate the trypsin
- Transfer cells to an RNase-free glass or polypropylene centrifuge tube (not supplied)
- Centrifuge at 500 x *g* for 5 minutes
- Aspirate the supernatant
- Proceed to **Step 3 below**

Note: Incomplete removal of the cell-culture medium will inhibit lysis and dilute the lysate. This will affect the conditions for binding of RNA to the RNA Mini Column and may reduce RNA yield.

3. Disrupt cells (do not use more than 1 x 10^7 cells) with RNA Lysis Buffer. Vortex or pipet up and down to mix thoroughly.
Note: Add 20 µl 2-mercaptoethanol per 1 ml RNA Lysis Buffer before use.

Note: For pelleted cells, loosen the cell pellet thoroughly by flicking the tube before adding the appropriate amount of RNA Lysis Buffer based on the table below. To directly lyse the cells in the culture dish, add the appropriate amount of RNA Lysis Buffer directly to the dish. Collect the cell lysate and transfer the cell lysate into a 1.5 ml microcentrifuge tube.

Number of Cells	Amount of RNA Lysis Buffer (µl)
< 5 x 10^6	350 µl
5 x 10^6 - 1 x 10^7	700 µl
Dish Diameter (cm)	**Amount of RNA Lysis Buffer (µl)**
< 6	350 µl
6-10	700 µl

4. Insert an RNA Homogenizer Mini Column into a 2 ml Collection Tube

5. Transfer the lysate to the RNA Homogenizer Mini Column

6. Centrifuge at 13,000 x *g* for 1 minute

7. Save the filtrate and discard the RNA Homogenizer Mini Column

8. Add 1 volume 70% ethanol. Vortex to mix thoroughly. Do not centrifuge
Note: A precipitate may form at this point. This will not interfere with the RNA purification. If any sample volume is lost during homogenization, adjust the volume of ethanol accordingly.

9. Insert an RNA Mini Column into a 2 ml Collection Tube

10. Transfer 700 µl sample (including any precipitate that may have formed) to the RNA Mini Column

11. Centrifuge at 10,000 x *g* for 1 minute

12. Discard the filtrate and reuse the Collection Tube

13. Repeat **Steps 10-12** until all of the sample has been transferred to the column

Optional: The starting point of the optional on-membrane DNase I Digestion Protocol. Since the matrix of the RNA Mini Column eliminates most DNA, DNase I digestion is not necessary for most downstream applications. However, certain sensitive RNA applications may require further DNA removal. If an additional RNA removal step is required, please continue to the DNase I Digestion Protocol in this document. (Note * DNase I is not provided and must be purchased separately). If DNase I digestion is not required, proceed to **Step 14**.

14. Add 500 µl RNA Wash Buffer I

15. Centrifuge at 10,000 x *g* for 30 seconds

16. Discard the filtrate and reuse the Collection Tube

17. Add 500 µl RNA Wash Buffer II
Note: RNA Wash Buffer II must be diluted with 100% ethanol before use. Please see "Preparing Reagents" section.

18. Centrifuge at 10,000 x *g* for 1 minute

19. Discard the filtrate and reuse the Collection Tube

20. Repeat **Steps 17-19** for a second RNA Wash Buffer II wash step

21. Centrifuge at maximum speed for 2 minutes to completely dry the RNA Mini Column
Note: It is important to dry the RNA Mini Column matrix before elution. Residual ethanol may interfere with downstream applications.

22. Transfer the RNA Mini Column to a clean 1.5 ml microcentrifuge tube (not provided)

23. Add 40-70 µl Nuclease-free Water
Note: Make sure to add water directly onto the RNA Mini Column matrix.

24. Centrifuge at maximum speed for 2 minutes and store eluted RNA at -70°C
Note: Any combination of the following steps can be used to help increase RNA yield

- Heat the Nuclease-free Water to 70°C before adding to the column
- Increase the incubation time to 5 minutes
- Increase the elution volume
- Repeat the elution step with fresh Nuclease-free Water (this may increase the yield but decrease the concentration)
- Repeat the elution step using the eluate from the first elution (this may increase yield while maintaining elution volume)

Animal Tissue Protocol

All centrifugation steps used are performed at room temperature.

Materials and Equipment to be Supplied by User:

- Microcentrifuge capable of at least 14,000 x *g*
- Vortexer
- RNase-free pipette tips
- RNase-free 1.5 ml microcentrifuge tubes
- 100% ethanol
- 70% ethanol in sterile DEPC-treated water
- 2-mercaptoethanol (β-mercaptoethanol)
- Disruption equipment
    - Glass beads
    - Rotor-stator homogenizer

Before Starting:

- Prepare RNA Lysis Buffer and RNA Wash Buffer II according to the "Preparing Reagents" section

1. Determine the proper amount of starting material

Note: It is critical to use the correct amount of tissue in order to obtain optimal yield and purity with the RNA Mini Column. The maximum amount of tissue that can be processed with the Total RNA Protocol is dependent on the tissue type and its RNA content. The maximum binding capacity of the RNA Mini Column is 100 µg. The maximum amount of tissue that RNA Lysis Buffer can lyse in this protocol is 30 mg. Use the table on the following page as a guideline to select the correct amount of starting material. If no information regarding your starting material is available, begin with 10 mg. Based on RNA yield and quality obtained from 10 mg, the starting amount can be adjusted for the next purification.

Average Yield of Total Cellular RNA from Mouse Tissue

Source	Amount of Tissue (mg)	RNA Yield (µg)
Brain	10	10
Kidney	10	30
Liver	10	45
Heart	10	5
Spleen	10	33
Lung	10	12
Pancreas	10	40
Thymus	10	20

2. Disrupt the tissue according to one of the following methods described below:

Amount of RNA Lysis Buffer per Tissue Sample

Amount of Tissue	Amount of RNA Lysis Buffer (µl)
≤ 15 mg	350 µl
20-30 mg	700 µl

Note: For samples stored in RNALater® use 700 µl RNA Lysis Buffer.

A. Rotor-Stator Homogenizer: Disrupt tissue with a rotor-stator homogenizer until the sample is uniform. See **Page 9** for details.

B. By using bead milling, cells and tissue can be disrupted by rapid agitation in the presence of glass beads and a lysis buffer. The optimal size of glass beads to use for RNA isolation are 0.5 mm for yeast/unicellular cells and 3-6 mm for animal tissue samples. Disrupt according to manufacturers recommended protocol. See the "Disruption Techniques for Tissue Samples" section for details.

3. Centrifuge at maximum speed for 5 minutes
Note: In some preparations, a fatty upper layer will form after centrifugation. Transfer of any of the fatty upper layer may reduce RNA yield or clog the column.

4. Insert an RNA Homogenizer Mini Column into a 2 ml Collection Tube

5. Transfer the lysate to the RNA Homogenizer Mini Column

6. Centrifuge at 13,000 x *g* for 1 minute
Note: Make sure that all of the liquid has passed through the RNA Homogenizer Mini Column after centrifugation. If necessary, repeat the centrifugation until all liquid passes through the membrane.

7. Save the filtrate and discard the RNA Homogenizer Mini Column

8. Transfer the cleared lysate to a clean 1.5 ml microcentrifuge tube (not provided)

9. Add 1 volume 70% ethanol. Vortex to mix thoroughly. Do not centrifuge.
Note: A precipitate may form at this point. This will not interfere with the RNA purification. If any sample has lost its volume during homogenization, adjust the volume of ethanol accordingly

10. Insert an RNA Mini Column into a 2 ml Collection Tube

11. Transfer 700 µl sample (including any precipitate that may have formed) to the RNA Mini Column

12. Centrifuge at 10,000 x *g* for 1 minute

13. Discard the filtrate and reuse the Collection Tube

14. Repeat **Steps 11-13** until all of the sample has been transferred to the column

Optional: This the starting point of the optional on-membrane DNase I Digestion Protocol. Since the matrix of the RNA Mini Column eliminates most DNA, DNase I digestion is not necessary for most downstream applications. However, certain sensitive RNA applications may require further DNA removal. If an additional RNA removal step is required, please continue to the DNase I Digestion Protocol.

Note: DNase I is not provided and must be purchased separately. If DNase I digestion is not required, proceed to **Step 15**.

15. Add 500 µl RNA Wash Buffer

16. Centrifuge at 10,000 x *g* for 30 seconds

17. Discard the filtrate and reuse the Collection Tube

18. Add 500 µl RNA Wash Buffer II
Note: RNA Wash Buffer II must be diluted with 100% ethanol before use. Please see "Preparing Reagents" section

19. Centrifuge at 10,000 x *g* for 1 minute

20. Discard the filtrate and reuse the Collection Tube

21. Repeat **Steps 18-20** for a second RNA Wash Buffer II wash step

22. Centrifuge at maximum speed for 2 minutes to completely dry the RNA Mini Column
Note: It is important to dry the RNA Mini Column matrix before elution. Residual ethanol may interfere with downstream applications.

23. Transfer the RNA Mini Column to a clean 1.5 ml microcentrifuge tube (not provided)

24. Add 40-70 µl Nuclease-free Water
Note: Make sure to add water directly onto the RNA Mini Column matrix.

25. Centrifuge at maximum speed for 2 minutes and store eluted RNA at -70°C
Note: Any combination of the following steps can be used to help increase RNA yield.

- Heat the Nuclease-free Water to 70°C before adding to the column
- Increase the incubation time to 5 minutes
- Increase the elution volume
- Repeat the elution step with fresh Nuclease-free Water (this may increase the yield but decrease the concentration)
- Repeat the elution step using the eluate from the first elution (this may increase yield while maintaining elution volume)

Vacuum Protocol

All centrifugation steps used are performed at room temperature.

Materials and Equipment to be Supplied by User:

- Microcentrifuge capable of at least 14,000 x *g*
- Vortexer
- Vacuum manifold
- Vacuum source
- RNase-free pipet tips and 1.5 ml microcentrifuge tubes
- 100% ethanol
- 70% ethanol in sterile DEPC-treated water
- 2-mercaptoethanol (β-mercaptoethanol)
- Disruption Equipment
    - Glass heads
    - Rotor-stator homogenizer

Before Starting:

- Prepare RNA Lysis Buffer and RNA Wash Buffer II according to the "Preparing Reagents" section
- Assemble vacuum manifold. Please see "Guidelines for Vacuum Manifold" for details

Note: Please read through previous sections of this manual before proceeding with this protocol. **Steps 1-8** from the Animal Cell protocol should be completed, or **Steps 1-9** from Animal Tissue Kit protocol should be completed before loading the sample to the RNA Mini Column. Instead of continuing with centrifugation, follow the steps below. Do not use more than $1x10^6$ cells or 10 mg tissue for the vacuum protocol.

1. Prepare the vacuum manifold according to manufacturer's instructions

2. Connect the RNA Mini Column to the vacuum manifold

3. Transfer the sample to the RNA Mini Column

4. Switch on the vacuum source to draw the sample through the column

5. Turn off the vacuum

6. Add 500 µl RNA Wash Buffer I

7. Switch on the vacuum source to draw the RNA Wash Buffer I through the column

8. Turn off the vacuum

9. Add 500 µl RNA Wash Buffer II
Note: RNA Wash Buffer II must be diluted with 100% ethanol before use. Please see "Preparing Reagents" section for details.

10. Switch on the vacuum source to draw the RNA Wash Buffer II through the column

11. Turn off the vacuum

12. Repeat **Steps 9-11** for a second RNA Wash Buffer II wash step

13. Transfer RNA Mini Column to a 2 ml Collection Tube provided with this kit

14. Centrifuge at maximum speed for 2 minutes to completely dry the RNA Mini Column
Note: It is important to dry the RNA Mini Column matrix before elution. Residual ethanol may interfere with downstream applications.

15. Transfer the RNA Mini Column to a clean 1.5 ml microcentrifuge tube (not provided)

16. Add 40-70 µl Nuclease-free Water
Note: Make sure to add water directly onto the RNA Mini Column matrix.

17. Centrifuge at maximum speed for 2 minutes and store eluted RNA at -70°C
Note: Any combination of the following steps can be used to help increase RNA yield.

- Heat the Nuclease-free Water to 70°C before adding to the column
- Increase the incubation time to 5 minutes
- Increase the elution volume
- Repeat the elution step with fresh Nuclease-free Water (this may increase the yield but decrease the concentration)
- Repeat the elution step using the eluate from the first elution (this may increase yield while maintaining elution volume)

DNase I Digestion Protocol

Since the matrix of the RNA Mini Column eliminates most DNA, DNase I digestion is not necessary for most downstream applications. However, certain sensitive RNA applications may require further DNA removal.

After completing **Steps 1-13** of the Animal Cell Protocol or **Steps 1-14** of the Animal Tissue Protocol, proceed with the following protocol.

User Supplied Material:

DNase I Digestion Set (Cat # 96-407)

1. For each RNA Mini Column, prepare the DNase I stock solution as follows:

Buffer	Volume per Prep
DNase I Digestion Buffer	73.5 µl
RNase-free DNase I (20 Kunitz/µL)	1.5 µl
Total Volume	75 µl

Important Notes:

- DNase I is very sensitive and prone to physical denaturing. Do not vortex the DNase I mixture. Mix gently by inverting the tube
- Freshly prepare DNase I stock solution right before RNA isolation
- Standard DNase buffers are not compatible with on-membrane DNase I digestion. The use of other buffers may affect the binding of RNA to the matrix and may reduce RNA yields and purity
- All steps must be carried out at room temperature. Work quickly, but carefully

2. Use the RNA Mini Column and 2 ml Collection Tube from **Step 13** (Animal Cell protocol) or from **Step 14** (Animal Tissue protocol) for **Step 3**

3. Add 250 µl RNA Wash Buffer I

4. Centrifuge at 10,000 x *g* for 1 minute

5. Discard the filtrate and reuse the Collection Tube

6. Add 75 µl DNase I digestion mixture directly onto the surface of the membrane of the RNA Mini Column
Note: Pipet the DNase I directly onto the membrane. DNA digestion will not be complete if some of the mixture is retained on the wall of the RNA Mini Column.

7. Let sit at room temperature for 15 minutes

8. Add 250 µl RNA Wash Buffer I

9. Let sit at room temperature for 2 minutes

10. Centrifuge at 10,000 x *g* for 1 minute

11. Discard the filtrate and reuse the Collection Tube

12. Add 500 µl RNA Wash Buffer II
Note: RNA Wash Buffer II must be diluted with 100% ethanol before use. Please see "Preparing Reagents" section for instructions.

13. Centrifuge at 10,000 x *g* for 1 minute

14. Discard the filtrate and reuse the Collection Tube

15. Repeat **Steps 12-14** for a second RNA Wash Buffer II wash step

16. Centrifuge at maximum speed for 2 minutes to completely dry the RNA Mini Column matrix
Note: It is important to dry the RNA Mini Column matrix before elution. Residual ethanol may interfere with downstream applications.

17. Place the column in a clean 1.5 ml microcentrifuge tube (not provided)

18. Add 40-70 µl Nuclease-free Water
Note: Make sure to add water directly onto the RNA Mini Column matrix.

19. Centrifuge at maximum speed for 2 minutes and store eluted RNA at -70°C
Note: Any combination of the following steps can be used to help increase RNA yield.

- Heat the Nuclease-free Water to 70°C before adding to the column
- Increase the incubation time to 5 minutes
- Increase the elution volume
- Repeat the elution step with fresh Nuclease-free Water (this may increase the yield but decrease the concentration)
- Repeat the elution step using the eluate from the first elution (this may increase yield while maintaining elution volume)

Troubleshooting Guide

Please use this guide to troubleshoot any problems that may arise. For further assistance, **please contact the technical support staff**.

Possible Problems and Suggestions

Problem	Cause	Solution
Little or no RNA eluted	• RNA remains on the column	• Repeat the elution step
	• Column is overloaded	• Reduce the amount of starting material
Problem	**Cause**	**Solution**
Clogged column	Incomplete homogenization	• Completely homogenize the sample • Increase the centrifugation time • Reduce the amount of starting material
Problem	**Cause**	**Solution**
Degraded RNA	• Starting culture problems	• Freeze starting material quickly in liquid nitrogen • Do not store tissue culture cells prior to extraction unless they are lysed first • Follow protocol closely and work quickly
	• RNase contamination	• Ensure not to introduce RNase during the procedure • Check buffers for RNase contamination
Problem	**Cause**	**Solution**
Problem in downstream applications	Salt carry-over during elution	• Ensure RNA Wash Buffer II has been diluted with 100% ethanol as indicated on bottle • RNA Wash Buffer II must be stored and used at room temperature • Repeat wash steps with RNA Wash Buffer II
Problem	**Cause**	**Solution**
DNA contamination	DNA contamination	• Digest with RNase-free DNase and inactivate DNase by incubation at 65°C for 5 minutes in the presence of EDTA
Problem	**Cause**	**Solution**
Low Abs ratios	RNA diluted in acidic buffer or water	• Nuclease-free Water is acidic and can dramatically lower Abs_{260} values. Use TE Buffer to dilute RNA prior to spectrophotometric analysis

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