ZYMO RESEARCH
The Beauty of Science is to Make Things Simple®

Peanuts®

A Biotechnical Newsletter

Vol. 13 Issue 1 2016

RNA Purification

Innovation. Pure & Simple.

Zymo Research

The leader in innovative RNA purification products

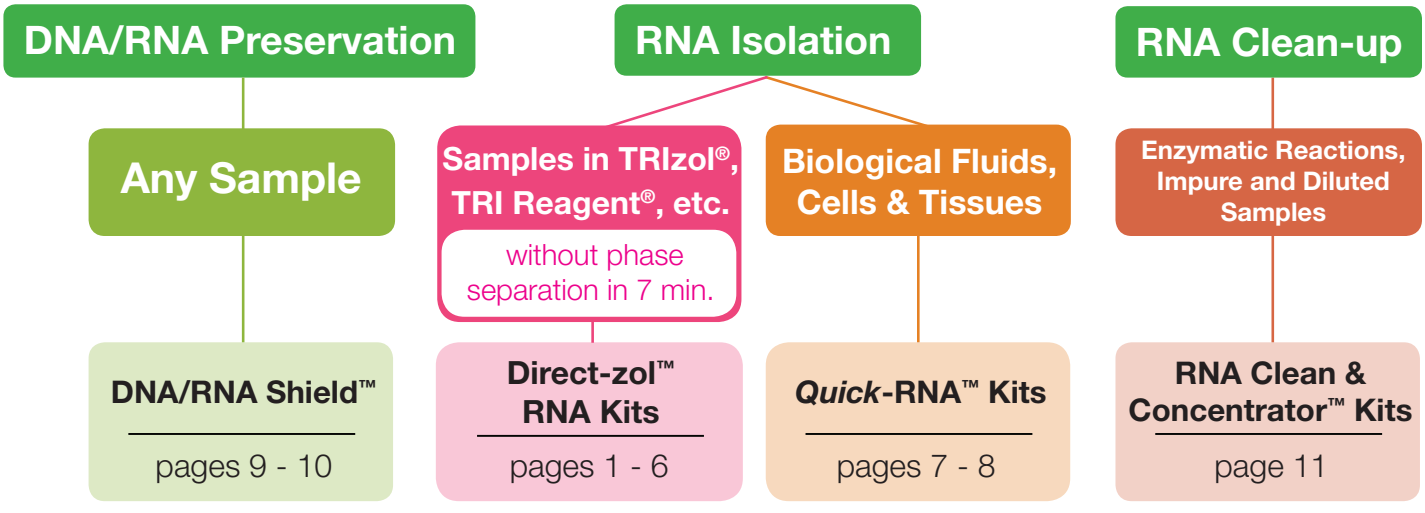
Zymo Research is reimagining how RNA is purified. From eliminating multiple steps in the RNA purification process to eliminating the need to refrigerate your RNA samples, we believe that quality and simplicity can be synonymous. Our innovative portfolio of products is guaranteed to both save you time on the work bench and improve the quality of your RNA product.

TRIzol in, RNA Out. Direct-zol™ streamlines and simplifies the purification process of high-quality RNA directly from samples in TRI Reagent® or similar reagents without the need for phase separation or alcohol precipitation. Taking only 7 minutes from start to finish, the groundbreaking method assures unbiased recovery and higher purity of small RNAs, including miRNA, compared to traditional methods.

Quick-RNA™ is a time-saving product line designed to easily and reliably isolate RNA from any sample. The kits combine a unique buffer system with Zymo-Spin™ column technology to quickly yield high quality total RNA in only 10 minutes.

Imagine not having to refrigerate and or use special equipment to preserve and protect your samples before isolating RNA. DNA/RNA Shield™ makes this a reality by ensuring nucleic acid stability by inactivating nucleases and infectious agents. Samples are stable for 30 day at ambient temperatures.

RNA Clean & Concentrator™ provides a simple and reliable method for the rapid clean up of high-quality DNA-free RNA from gels, RT-PCR reactions, or oligo synthesis. This procedure owes its simplicity to a unique single-buffer system and Zymo-Spin™ column technology for no wash buffer carry over and a 6 µl elution.



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Innovative RNA Purification Technologies

In the Literature

Other Technologies

ZYMO RESEARCH

The Beauty of Science is to Make Things Simple®

RNA Purification *Made Simple™*

Direct-zol™ RNA

- **7 minutes from TRIzol® to high-quality RNA without phase separation**
- RNA is high-quality and DNA-free, suitable for subsequent molecular manipulation and analysis.
- Non-biased miRNA recovery.

Never phase separate again

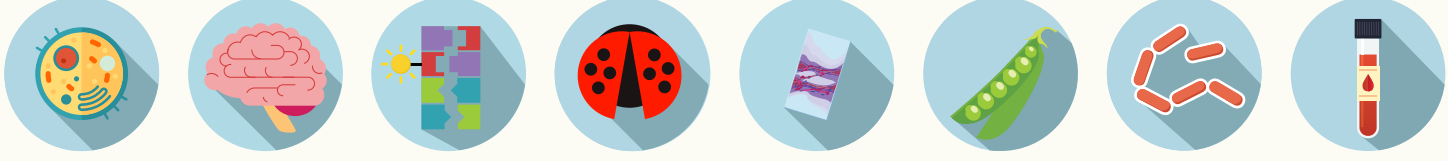
The Direct-zol™ RNA MiniPrep facilitates efficient and consistent broad size-range purification (including miRNAs) of high quality (DNA- free) total RNA directly from any sample stored in TRIzol®, TRI Reagent®, and all other acid-guanidinium-phenol based reagents. The innovative Direct-zol™ procedure bypasses phase separation and precipitation steps with a spin column format, saving time and also eliminating phenol carryover without compromising RNA quality.

The Direct-zol™ technology couples the effectiveness of TRI Reagent® for infectious agent inactivation and sample preservation with a convenient no hassle, no mess procedure for DNA-free RNA. The Direct-zol™ procedure is ideal for both routine lab use and high- throughput and automated applications.

Streamlined workflow

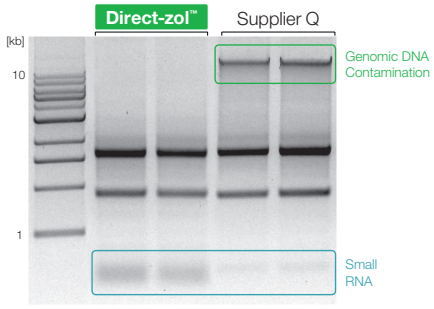
Accommodates any sample in TRIzol®, TRI Reagent®, etc.

including cells, tissues, *in vitro* reactions, tough-to-lyse samples, FFPE, plants, microorganisms, and body fluids.



www.zymoresearch.com Tel: (949) 679-1190

Total RNA Recovery



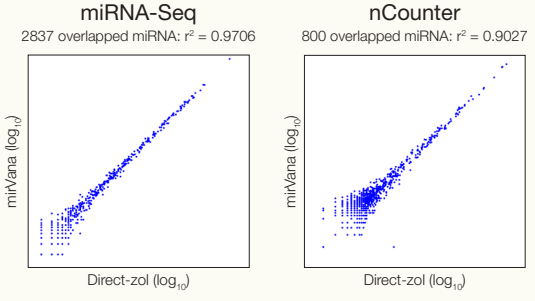
High-quality small and large RNAs are effectively recovered using the Direct-zol™ kit. RNA is DNA-free.

Non-biased miRNA Recovery

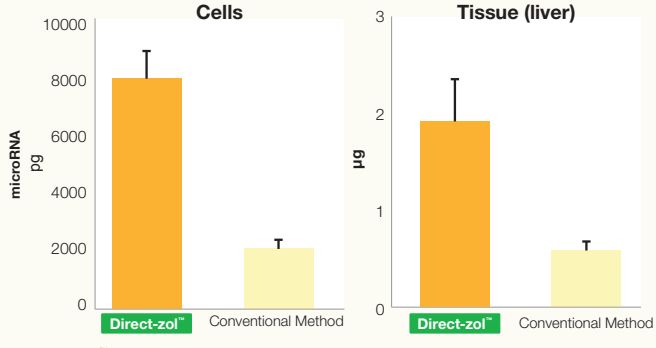
Accurate RNA analysis begins with high-quality RNA. Historically, the "gold standard" for RNA purification has involved complicated phase separation and precipitation methods using TRIzol®, TRI Reagent®, etc. These conventional extraction methods can have biasing effects on what you actually recover. Kim et. al. have shown that for Trizol extractions there is bias in miRNA recovery depending on the amount of input used—small RNAs with low GC content were lost when the amount of cells were smaller.

The importance of miRNAs and other small RNAs in regulating gene expression and other cellular processes is clear. Many small RNAs are expressed at low abundance, or only in specific cell types, so to obtain results you can trust, you need to recover ALL small RNAs during your purification. Ensure that you recover the highest yields of high-quality small RNAs from your samples with Zymo Research's RNA purification technologies.

Direct-zol™ RNA recovers the most miRNAs and small RNAs!



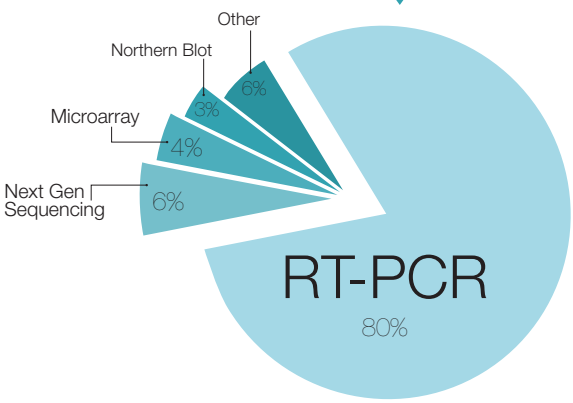
The data show RNA purified from TRIzol® samples using the Direct-zol™ RNA MiniPrep compared to an unbiased method (mirVana™, Ambion). Micro-RNA analysis was performed using miRNA-Seq (MiSeq®, Illumina) and a direct hybridization assay (nCounter®, Nanostring).



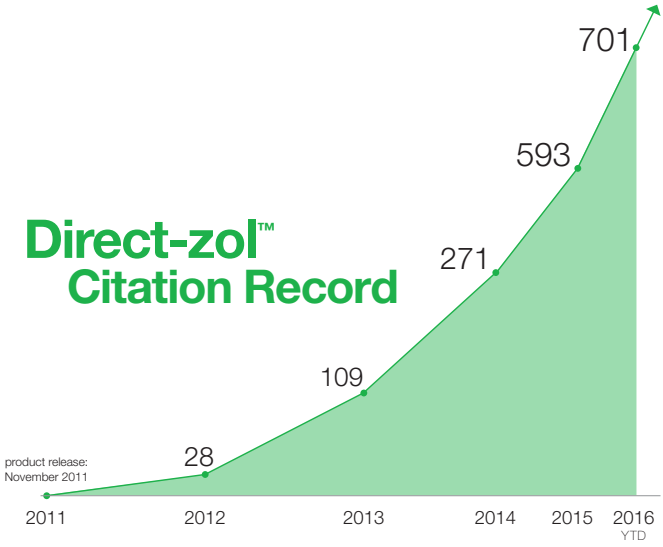
The Direct-zol™ RNA MiniPrep recovered ~4-fold more miRNAs (<40 nt) than conventional methods. miRNAs purified from cells and tissue were quantified using the Bioanalyzer, small RNA chip.

Kim, Young-Kook et al. 2012. Molecular Cell. Short Structured RNAs with Low GC Content Are Selectively Lost during Extraction from a Small Number of Cells

What was your **downstream application?**



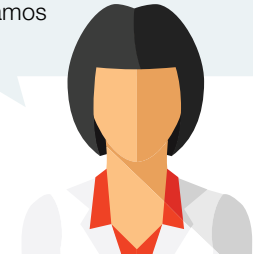
Direct-zol™ Citation Record



94% of researchers recommend Direct-zol™ to a colleague

Direct-zol is the most excellent kit for RNA isolation that I ever used in the past 20 years.
-H.Z. (Joslin Diabetes Center, Harvard Medical School)

I just got the results from a two sample test of your kit and wow. We're seeing a 5-10 fold increase in extraction efficiency of RNA from mixed viral/ host samples. We are now excited to re-extract our remaining samples and use all as template for cDNA synthesis and sequencing.
-S.J. (Genome Science, Los Alamos National Laboratory)



The Direct-zol RNA MiniPrep showed the highest recovery [of miRNA] from both cell culture and frozen post-mortem human brain tissue when compared to miRNeasy, mirVana and RNeasy Plus.
-O.E. (University of Southern California)

The ratio 260/280=1.98, 260/230=1.89, RIN=9. Excellent for expression array!
-J.W. (The Methodist Hospital Research Institute, Houston, TX)

Product	Size	Catalog Number
Direct-zol™ RNA MiniPrep Plus	50 Preps. 200 Preps.	R2070, R2071* R2072, R2073*
Direct-zol™ RNA MiniPrep	50 Preps. 200 Preps.	R2050, R2051* R2052, R2053*
Direct-zol™ RNA MicroPrep	50 Preps. 200 Preps.	R2060, R2061* R2062, R2063*

Patent Pending

* = Supplied with TRI Reagent®

Learn More at: **www.zymoresearch.com/rna/direct-zol**

www.zymoresearch.com Tel: (949) 679-1190

Direct-zol™ Applications as shown in Nature

Long non-coding RNAs, CRISPR/Cas9 genome editing, RNA sequencing

» Quinn, J et al. Revealing Long Noncoding RNA Architecture And Functions Using Domain-Specific Chromatin Isolation By RNA Purification. Nature Biotechnology. 2014
» Ranganathan, V et al. Expansion Of The CRISPR–Cas9 Genome Targeting Space Through The Use Of H1 Promoter-Expressed Guide Rnas. Nature Communications. 2014
» Shishkin, A et al. Simultaneous Generation Of Many RNA-Seq Libraries In A Single Reaction. Nature Methods. 2015

Cancer Research

» Chen, Y-L et al. Remnant Living Cells That Escape Cell Loss In Late-Stage Tumors Exhibit Cancer Stem Cell-Like Characteristics. Cell Death Disease. 2012
» Beronja, S et al. Rnai Screens In Mice Identify Physiological Regulators Of Oncogenic Growth. Nature. 2013
» Gad, Helge et al. MTH1 Inhibition Eradicates Cancer By Preventing Sanitation Of The Dntp Pool. Nature. 2014
» Siegle, J et al. SOX2 Is A Cancer-Specific Regulator Of Tumour Initiating Potential In Cutaneous Squamous Cell Carcinoma. Nature Communications. 2014

Evolutionary & Developmental Biology

» Patterson, L et al. Pigment Cell Interactions And Differential Xanthophore Recruitment Underlying Zebrafish Stripe Reiteration And Danio Pattern Evolution. Nature Communications. 2014
» Bahn, J H et al. Genomic Analysis Of ADAR1 Binding And Its Involvement In Multiple RNA Processing Pathways. Nature Communications. 2015
» Kim, J et al. Dietary Sugar Promotes Systemic TOR Activation In Drosophila Through AKH-Dependent Selective Secretion Of Dilp3. Nature Communications. 2015
» Stanganello, E et al. Filopodia-Based Wnt Transport During Vertebrate Tissue Patterning. Nature Communications. 2015
» Sugimoto, Yoichiro et al. Hiclip Reveals The In Vivo Atlas Of Mrna Secondary Structures Recognized By Staufen 1. Nature. 2015

Heart Disease Research

» Huang, C-Y et al. ANG II Promotes IGF-IIR Expression And Cardiomyocyte Apoptosis By Inhibiting HSF1 Via JNK Activation And SIRT1 Degradation. Cell Death and Differentiation. 2014
» Traister, A et al. Integrin-Linked Kinase Mediates Force Transduction In Cardiomyocytes By Modulating Serca2a/PLN Function. Nature Communications. 2014

Vaccines and Therapeutics: Ebola and Malaria

» Thi, E et al. Lipid Nanoparticle Sirna Treatment Of Ebola-Virus-Makona-Infected Nonhuman Primates. Nature. 2015
» Mire, C et al. Single-Dose Attenuated Vesiculovax Vaccines Protect Primates Against Ebola Makona Virus. Nature. 2015
» Mikolajczak, S et al. A Next-Generation Genetically Attenuated Plasmodium Falciparum Parasite Created By Triple Gene Deletion. Molecular Therapy. 2014

Neuroscience

» Cheng, C et al. In Vivo SELEX For Identification Of Brain-Penetrating Aptamers. Molecular Therapy — Nucleic Acids. 2013
» Chang, K-J et al. Glial Ankyrins Facilitate Paranodal Axoglial Junction Assembly. Nature Neuroscience. 2014
» Most, D et al. The Synaptoneurosome Transcriptome: A Model For Profiling The Emolecular Effects Of Alcohol. The Pharmacogenomics Journal. 2014

Stem-cell Research

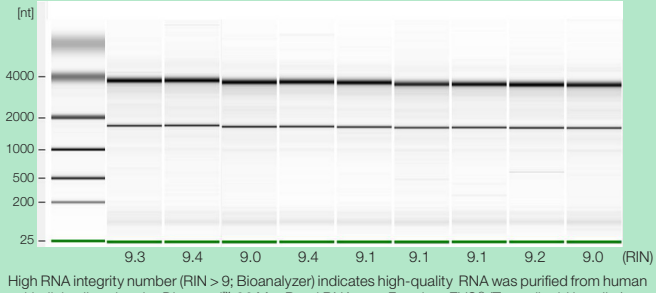
» Chang, C-Y et al. NFIB Is A Governor Of Epithelial–Melanocyte Stem Cell Behaviour In A Shared Nich'. Nature. 2013
» Lien, W-H et al. In Vivo Transcriptional Governance Of Hair Follicle Stem Cells By Canonical Wnt Regulators. Nature Cell Biology. 2014
» Adam, R. et al. Pioneer Factors Govern Super-Enhancer Dynamics In Stem Cell Plasticity And Lineage Choice. Nature. 2015

MicroRNA Therapeutics

» Dias, C et al. B-Catenin Mediates Stress Resilience Through Dicer1/Microrna Regulation. Nature. 2014

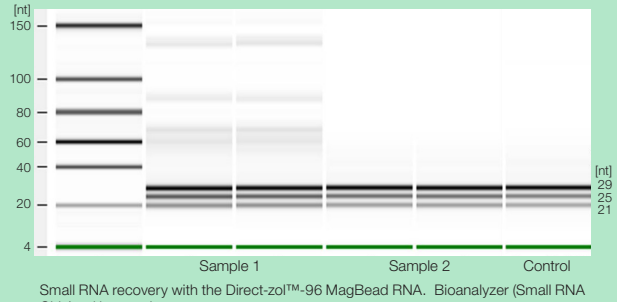
High-Throughput & Automated Purification of High-Quality Total RNA

High quality RNA

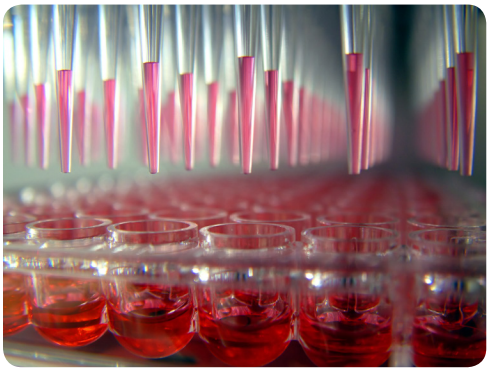


High RNA integrity number (RIN > 9; Bioanalyzer) indicates high-quality RNA was purified from human epithelial cells using the Direct-zol™-96 MagBead RNA on a Freedom EVO® (Tecan liquid handler).

Efficient small RNA recovery



Small RNA recovery with the Direct-zol™-96 MagBead RNA. Bioanalyzer (Small RNA Chip) gel image shown.



For rapid, high-throughput isolation of ultra-pure RNA, Zymo Research offers RNA Purification kits in 96-well and magnetic bead formats.

Product	Size	Catalog Number
Direct-zol™-96 MagBead RNA	2 x 96 preps. 4 x 96 preps. 8 x 96 preps.	R2100, R2101* R2102, R2103* R2104, R2105*
Direct-zol™-96 RNA	2 x 96 preps. 4 x 96 preps.	R2054, R2055* R2056, R2057*

* = Supplied with TRI Reagent®

Application Note

Direct-zol™ RNA: Discovering a key Alzheimer's disease marker

Carlos J. Rodriguez-Ortiz & Masashi Kitazawa, School of Natural Sciences, University of California, Merced

Alzheimer's disease (AD) is a leading cause of dementia among elderly, and over **5 million people** are affected in the U.S. alone.

The exact molecular mechanism of Alzheimer's disease is not well understood yet. We investigated whether changes in microRNA profile in the brain play a critical role in the disease progression. MicroRNAs are small RNAs that can regulate gene expression at the post-transcriptional level for a wide range of cellular processes. Recent research has shown microRNAs involvement in a large collection of neurobiology processes including synaptic plasticity [1].

Total RNA was purified from murine dorsal or ventral hippocampus lysates using the Direct-zol RNA MiniPrep kit. Quality of RNA was determined in a 2100 Bioanalyzer (Agilent Technologies)—All RINs ≥8.5. cDNA was produced from 500ng purified RNA using the NCODE Vilo cDNA systhesis kit (Life Technologies). For qPCR, cDNA was amplified on a MyIQ thermocycler (Biorad) using the SensiMix SYBR & Fluorescein kit (Bioline).

> "The Direct-zol™ RNA MiniPrep kit **effectively purified small RNAs** for qPCR-detection of microRNAs."

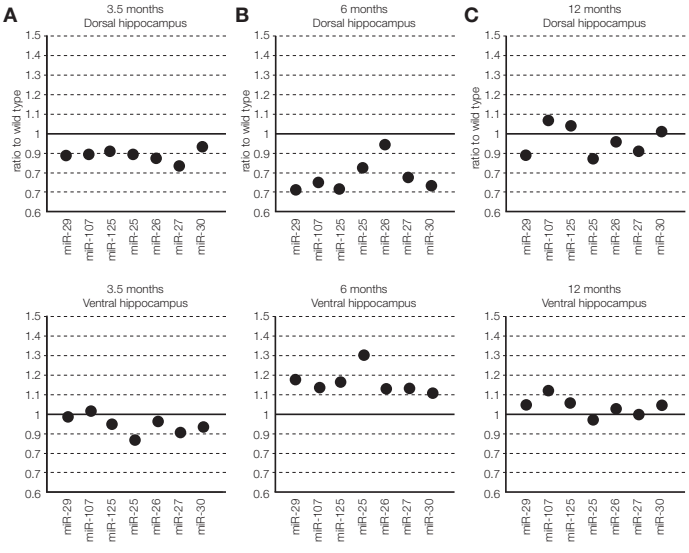


Figure 1. qPCR results for microRNAs evaluated in this study. microRNAs levels at 3.5 (A), 6 (B) and 12 months of age (C).

Analysis of microRNAs was done separately in the dorsal and ventral regions of the hippocampus since pathology is first evident in the ventral part of the hippocampus and in later stages it migrates to the dorsal region of the AD mouse model [2].

We analyzed microRNAs at three different ages: 3.5-month (pre-symptomatic), 6-month (early symptomatic) and 12-month (symptomatic) old. Figure 1 shows that most of the microRNAs assessed were not statistically different between genotypes of the three ages. However, microRNA (miR)-181 was significantly increased in the ventral hippocampus of 6-month old 3xTg-AD ($t(9) = 2.25$, $P < 0.05$) (Fig.2B). Augmented levels of miR-181 were also observed at 12 months in both dorsal ($t(9) = 3.99$, $P < 0.01$) and ventral ($t(9) = 2.41$, $P < 0.05$) regions of the hippocampus (Fig.2A-B). On the contrary, increased miR-181 was not detected in pre-pathological 3.5-month old 3xTg-AD mice.

These findings indicate a dysregulation in miR-181 in a mouse model of AD and suggest that changes in microRNAs may be critically involved in the development of AD neuropathology.

> "The Direct-zol™ RNA miniprep kit **effectively purifies microRNA** from sub-regions of the mouse hippocampus and helps to **identify key microRNAs.**"

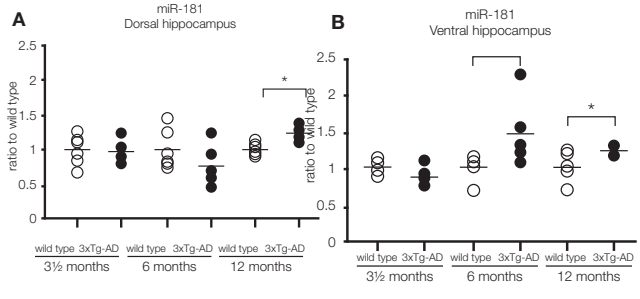


Figure 2. miR-181 levels for the dorsal (A) and ventral hippocampus (B) at 3.5, 6 and 12 months of age. Significant differences were detected in 12 month-old dorsal and ventral hippocampus, and at 6 months in the ventral hippocampus. * = $p < 0.05$.

Source. The results presented in this note are part of the publication: Upregulation of miR-181 Decreases c-Fos and SIRT-1 in the Hippocampus of 3xTg-AD Mice. J Alzheimers Dis. 2014 42:1229-1238.
Acknowledgements. This study was funded by the Alzheimer's Association NIRG-12-242598.

References

[1] Christensen M, Schratt GM (2009) Neurosci Lett 466, 55-62.
[2] Mastrangelo MA, Bowers WJ (2008) BMC Neurosci 9, 81.
[3] Ruijter JM, et al. (2009) Nucleic Acids Res 37, e45.

Direct-zol™ RNA: Identifying therapeutic targets to prevent blindness

Tom Sundermeier, Case Western Reserve University, School of Medicine, Cleveland, OH

Application Note

Photoreceptor cell death is the primary cause of blindness in most retinal degenerative disorders, including **retinitis pigmentosa** and **age related macular degeneration**.

Understanding the gene regulatory networks that regulate photoreceptor cell death and designing therapies to promote photoreceptor survival are critical for combating blindness.

Using a mature rod photoreceptor-specific *Dicer1* conditional knockout mouse model, we demonstrated that miRNA gene regulation is essential for the survival of postmitotic rod photoreceptor neurons. Loss of DICER1 led to a primary defect in cell survival, implicating rod miRNAs as factors regulating the survival of this cell type.

> **miRNA-based gene therapy** approaches are an emerging strategy promising **improved efficacy** by targeting multiple genes within the same pathway.

We used our novel conditional knockout mouse model as a genetic tool to assess miRNA expression in mature rods. Applying this strategy, we identified several abundant families rod photoreceptor miRNAs as candidate therapeutic targets for promoting photoreceptor survival to prevent, delay or ameliorate a broad class of blinding retinal diseases [1].

To identify abundant candidate therapeutic target miRNAs in rods, we employed a comparative small RNAseq approach. Comparing the fractional abundance of retinal miRNAs between rod-specific *Dicer1* conditional knockout animals and control littermates, thus revealed which miRNA families are primarily expressed in rods. However, we experienced a significant setback during the process of small RNA library preparation arising from the fact that rods represent about 90% of the cells in the retina [2], hence loss of rod miRNAs led to a significant decline in the fractional abundance of small RNAs in retinas isolated from conditional knockout animals **(Figure 1)**. This issue led to challenges both with small RNA purification and library preparation as well as with the complexity of the resulting libraries.

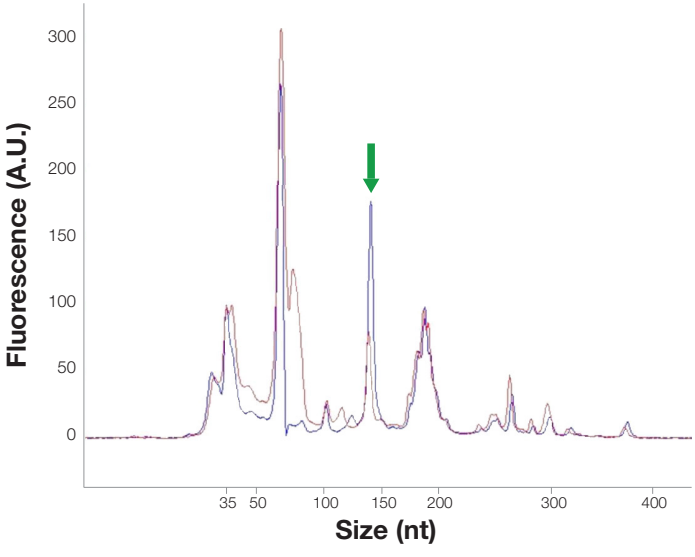


Figure 1. Rod-specific Dicer1 conditional knockout retinas contain significantly fewer small RNA molecules. A graph of fluorescence *vs.* DNA length from bioanalyzer analysis of the adapter-ligated sequences used to generate small RNAseq libraries is shown for control (**blue**) or cKO (**red**) mouse retinas. The green arrow indicates the ~140nt peak corresponding to miRNAs (22-25nt plus ~120nt adapter sequences).

> Switching to the Zymo Direct-zol RNA kit helped us to **increase the fractional abundance of small RNAs, facilitating more representative small RNA libraries.**

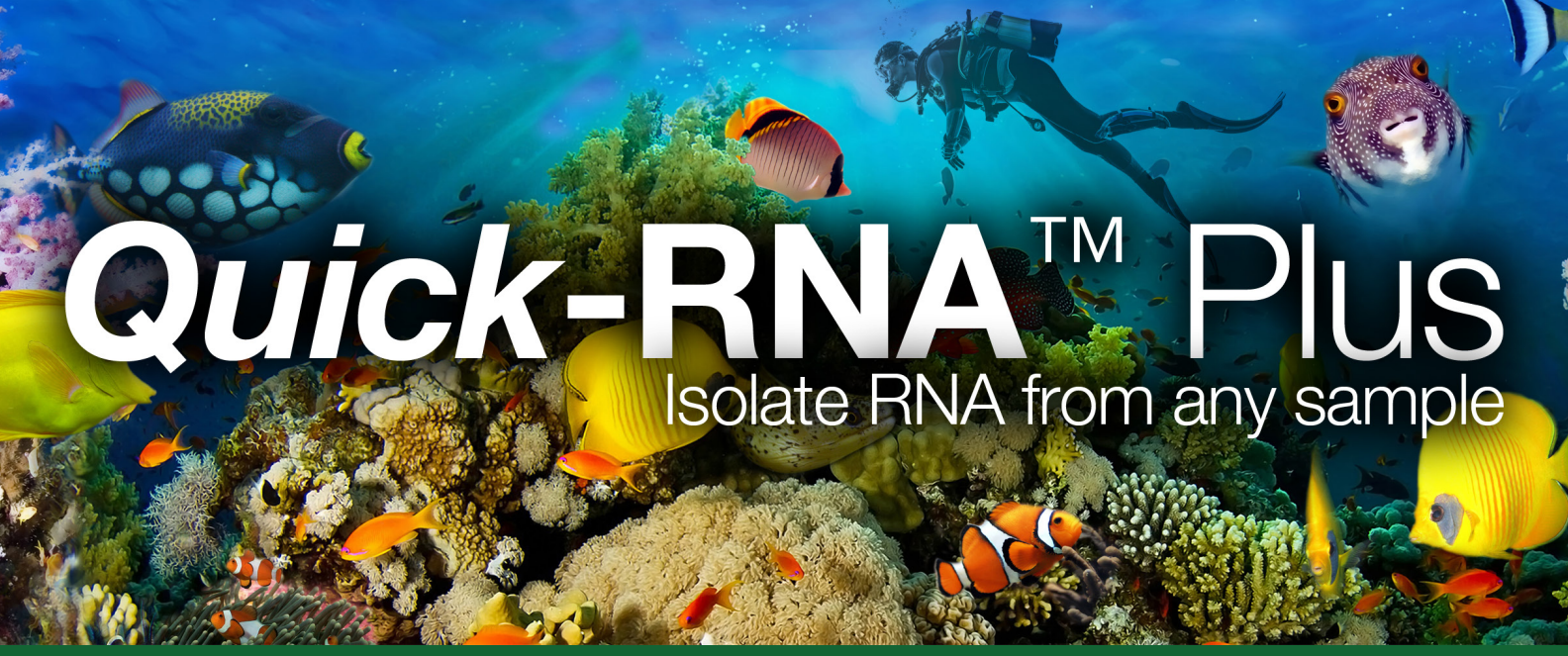
This change, in combination with spiking in known RNA sequences helped us to overcome the challenges and reliably identify rod-specific miRNAs as therapeutic targets for retinal degeneration.

Source. The results presented in this note are part of the publication: Upregulation of miR-181 Decreases c-Fos and SIRT-1 in the Hippocampus of 3xTg-AD Mice. J Alzheimers Dis. 2014 42:1229-1238.

References

[1] Sundermeier TR, Zhang N, Vinberg F, Mustafi D, Kohno H, Golczak M, et al. DICER1 is essential for survival of postmitotic rod photoreceptor cells in mice. FASEB journal : official publication of the Federation of American Societies for Experimental Biology. 2014;28(8):3780-91.

[2] Jeon CJ, Strettoi E, Masland RH. The major cell populations of the mouse retina. The Journal of neuroscience : the official journal of the Society for Neuroscience. 1998;18(21):8936-46.



Quick-RNA™ Plus

Isolate RNA from any sample

Highlights

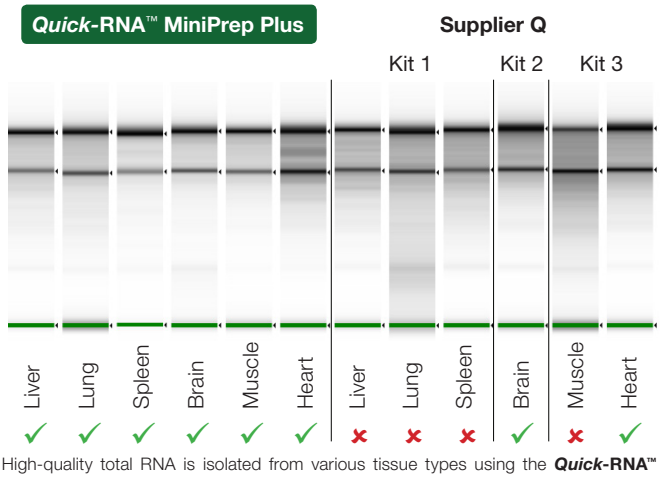
- High-quality total RNA from a wide range of samples – single to 10^7 cells.
- Isolate small and large RNAs into separate fractions (optional).
- DNA-free RNA for use in any downstream application.
- Samples in DNA/RNA Shield™ can be input directly without reagent removal.

High-quality RNA from any sample source

The Quick-RNA™ kits are innovative products designed for the easy, reliable, and rapid isolation of DNA-free total RNA from a wide range of cell and tissue samples. The procedure combines a unique buffer system with Zymo-Spin™ column or plate technology to yield high quality total RNA (including small RNAs 17-200 nt) in minutes. The procedure is simple: Add the provided RNA Lysis Buffer to extract total RNA from the cells of interest, then purify the RNA using the provided Zymo-Spin™ columns or plate. The result is highly-concentrated, DNA-free RNA that is suitable for subsequent RNA-based methods including RT-PCR, hybridization, sequencing etc. In addition, the kit can be used for enrichment of small and large RNAs in two separate fractions.

	***Quick*-RNA™**	Supplier Q
Small RNA (≥17 nt) recovery	Yes	No
DNase I included	Yes	No
gDNA removal column included	Yes	No
Proteinase K	Yes*	No
DNA/RNA Shield™ (for sample storage)	Yes*	No

**Quick*-RNA™ MiniPrep Plus*



High-quality total RNA is isolated from various tissue types using the ***Quick*-RNA™ MiniPrep Plus** kit. In comparison, RNA isolated from the same tissue types using three kits recommended by Supplier Q (Agilent 2200 TapeStation; RIN/red = low quality).

Quick-RNA in the literature

Synthetic Biology

» Ausländer, S et al. A general design strategy for protein-response **riboswitches** in mammalian cells. Nature Methods. 2014
» Curran, KA et al. Design of synthetic yeast promoters via tuning of **nucleosome architecture**. Nature Communications. 2014

Chromatin & Nucleosome

» Pérez-Lluch, S et al. Absence of canonical marks of active chromatin in **developmentally regulated genes**. Nature Genetics. 2015
» Han, P et al. A **long noncoding RNA** protects the heart from pathological hypertrophy. Nature. 2014

Immunology & Cell Signaling

» Tischner, D et al. Mutual antagonism of TGF-beta and Interleukin-2 in **cell survival** and lineage commitment of induced regulatory T cells. Cell Death & Differentiation. 2012
» Vogel, C et al. Aryl hydrocarbon receptor signaling regulates NF-kB RelB activation during **dendritic-cell differentiation**. Immunology & Cell Biology. 2013

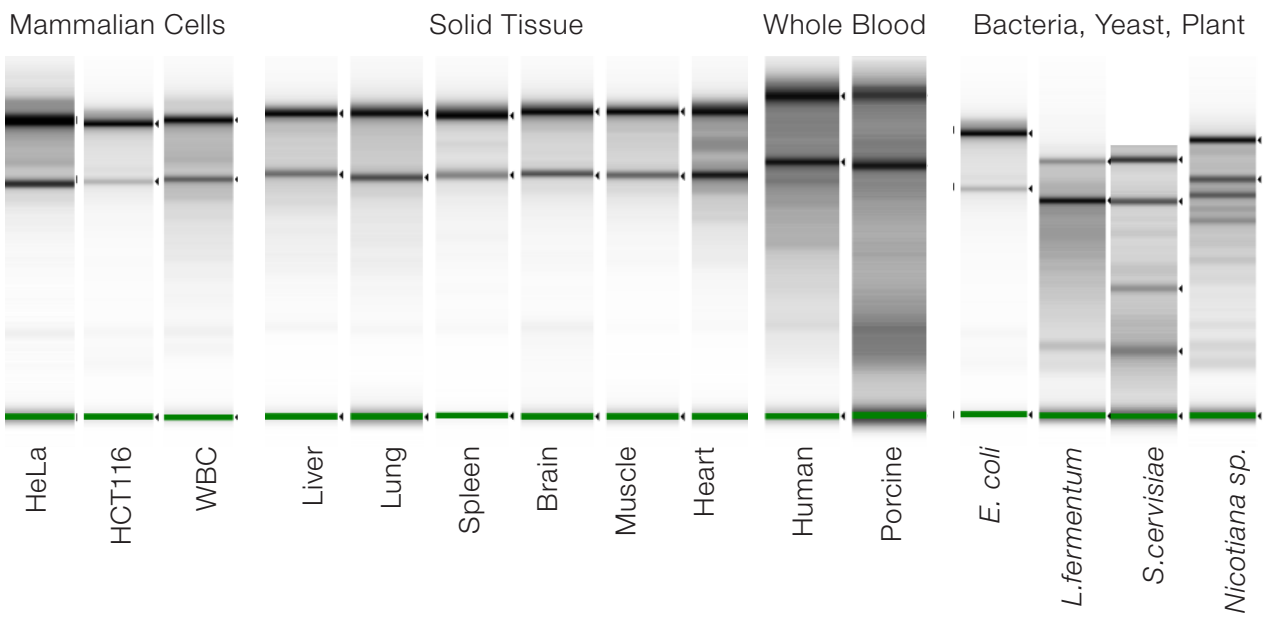
Pathogens

» Desjardins, CA et al. Contrasting **host-pathogen interactions** and genome evolution in two generalist and specialist microsporidian pathogens of mosquitos. Nature Communications. 2015

Cell Imaging

» Chen, KH et al. Spatially resolved, highly multiplexed **RNA profiling in single cells**. Science. 2015

Sample Inputs



High-quality total RNA is isoalted from various sample types including mammalian cells, solid tissue, whole blood, bacteria, yeast, and plant using the *Quick*-RNA™ MiniPrep Plus kit (Agilent 2200 TapeStation).

Product	Input*	Binding	Elution	Cat. No.	Size
Quick-RNA™ MicroPrep	1 - 10^6 cells 5 mg tissue	10 µg	≥ 6 µl	R1050 R1051	50 Preps 200 Preps
Quick-RNA™ MiniPrep	10^2 - 10^7 cells 50 mg tissue	100 µg	≥ 50 µl	R1054 R1055	50 Preps 200 Preps
Quick-RNA™ MiniPrep Plus	10^2 - 10^7 cells 50 mg tissue	100 µg	≥ 50 µl	R1057 R1058	50 Preps 200 Preps
Quick-RNA™ MidiPrep	10^6 - 10^8 cells 250 mg tissue	1 mg	≥ 200 µl	R1056	25 Preps
ZR-96 *Quick-RNA*™	1 - 10^6 cells 5 mg tissue	10 µg/well	≥ 25 µl	R1052 R1053	2 x 96 Preps 4 x 96 Preps

Sample Collection & Stabilization for Nucleic Acid Analysis

DNA/RNA Shield™

Pathogen Inactivation

Inactivates viruses, bacteria, yeast & protists

Break the Cold Chain

Not the bank!

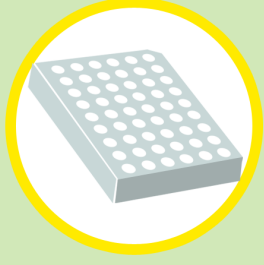
Transport at ambient temperatures

Streamlined Purification of DNA & RNA

No reagent removal

Compatible with all purification kits (incl. *Quick*-RNA™, *Quick*-DNA™ Universal, etc.)

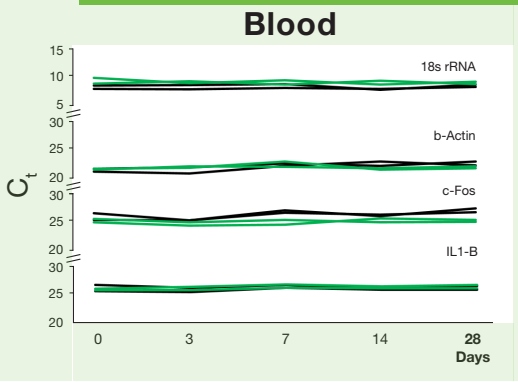
Fully automatable



Ready for all downstream applications

- Next Gen Sequencing
- Arrays
- (rt)PCR

Nucleic acid stabilization at ambient temperature

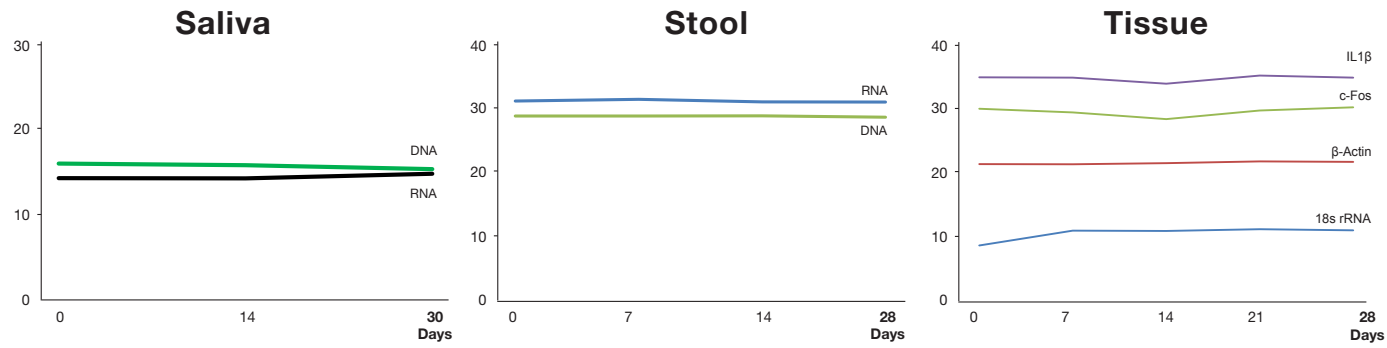


Convenience & Safety

Draw 3 mL whole blood directly into DNA/RNA Shield™ blood collection tubes and avoid handling dangerous samples

Nucleic Acid Stabilization

Immediately stabilize DNA & RNA from whole blood. Nucleic acid is stable for up to 1 month at ambient temperatures.

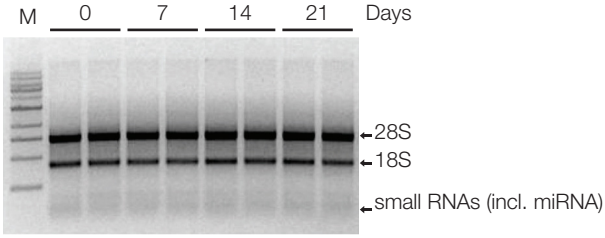


RNA in blood, saliva, stool and tissue is effectively stabilized in DNA/RNA Shield™ at ambient temperature. Graphs show: cellular RNA from human whole blood and spike-in DNA and RNA controls from saliva, stool and tissue purified at the indicated time points and analyzed by (RT)qPCR. Controls: HSV-1 and HIV (AcroMetrix, Life Technologies).

Streamlined Purification

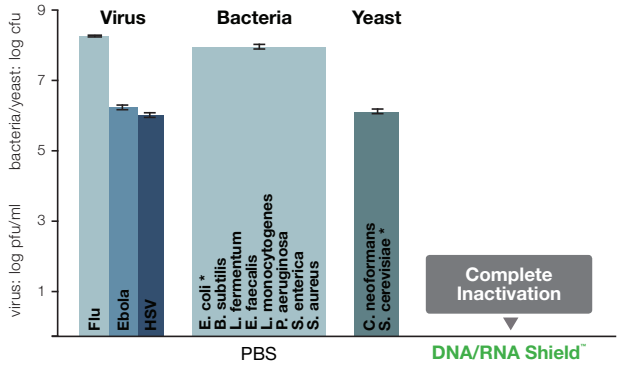
The reagent does not require removal and is **directly compatible** with most off-the-shelf purification kits:

***Quick*-DNA™ Universal** (D4068)
***Quick*-gDNA™** (D3006)
***Quick*-RNA™** (R1057)
ZR-Duet DNA/RNA™ (D7003)



RNA from cells is effectively stabilized in DNA/RNA Shield™ at ambient temperature. Data show RNA from human cells (HCT 116) purified at the indicated time points and visualized on agarose gel.

Microbial Inactivation



Viruses, bacteria and yeast are effectively inactivated by DNA/RNA Shield™. Samples containing the infectious agent (virus, bacteria, yeast) were treated with DNA/RNA Shield™ or mock (PBS) treated for 5 minutes. Titer (PFU) was subsequently determined by plaque assay. **Validated by:** Influenza A - D. Poole and Prof. A. Mehle, Department of Medical Microbiology and Immunology, University of Wisconsin, Madison; Ebola (Kikwit) - L. Avena and Dr. A. Griffiths, Department of Virology and Immunology, Texas Biomedical Research Institute; HSV-1/2 - H. Oh, F. Diaz and Prof. D. Knipe, Virology Program, Harvard Medical School; E. coli, L. fermentum, B. subtilis, S. cerevisiae – Zymo Research Corporation)

*Disclaimer: This graph only displays results from *E. coli* inactivation. Each microbe was tested independently and were combined into one graph for brevity. Bacterial cultures were grown between 10^8 - 10^9 cells and yest cultures were grown between 10^7 - 10^8 cells.

Product	Recommended usage	Size	Cat. No.
DNA/RNA Shield™	Solid Samples Up to 10% (v/v)	50 ml 250 ml	R1100-50 R1100-250
DNA/RNA Shield™ 2x concentrate	Liquid Samples Mix reagent and sample 1:1	25 ml 125 ml	R1200-25 R1200-125

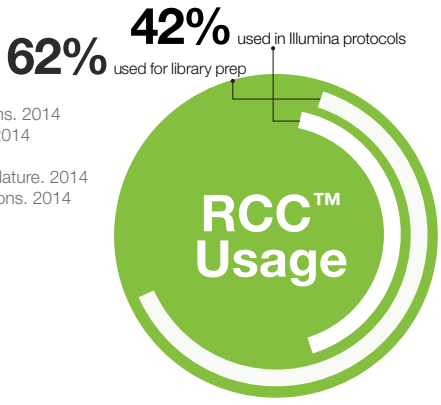
For bulk reagent & custom fill into any existing collection device, inquire.

References: Nowotny, N., and J. Kolodziejek. "Middle East respiratory syndrome coronavirus (MERS-CoV) in dromedary camels, Oman, 2013." Euro Surveill 19 (2014): 15

RNA Clean & Concentrator™

» Cleans and concentrates total RNA (including small RNAs and miRNA) from enzymatic and labeling reactions, *in vitro* reactions, etc. suitable for any downstream application including RNA-seq, reverse transcription, microarray, etc.

RNA-seq



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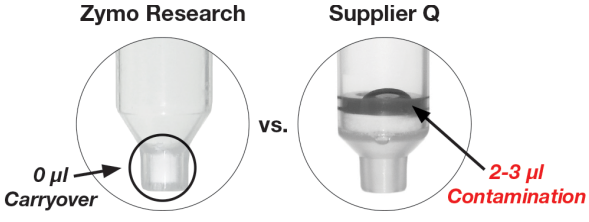


Product	Cat. No.
RNA Clean & Concentrator™-5	R1015 (50 prep.), R1015 (200 prep.) R1013* (50 prep.), R1014* (200 prep.)
RNA Clean & Concentrator™-25	R1017 (50 prep.), R1018 (100 prep.)
RNA Clean & Concentrator™-100	R1019 (25 prep.)
ZR-96 RNA Clean & Concentrator™	R1080 (2x96 well)

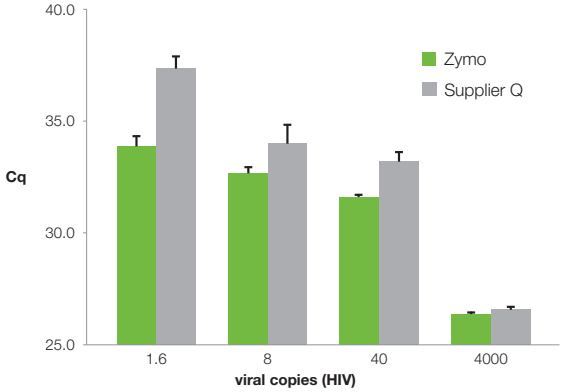
** = DNase I included*

ZR Viral RNA Kit™

Streamlined Workflow for Superior Sensitivity

Product	Cat. No.
ZR Viral RNA Kit™	R1034 (50 prep.) R1035 (200 prep.)
ZR-96 Viral RNA Kit™	R1040 (50 prep.) R1041 (200 prep.)
ZR Viral DNA/RNA Kit™	D7020 (50 prep.) D7021 (200 prep.)

Also compatible with samples deactivated using DNA/RNA Shield™



The **ZR Viral RNA Kit™** from Zymo Research ensures high sensitivity viral detection compared to that of Supplier Q. Viral RNA was isolated from plasma samples using the ZR Viral RNA Kit™. Data are the mean (+/- SD) of triplicate RTqPCR measurements.

Other Products

ZymoPURE™ Plasmid Kits

Get transfection ready, high-quality plasmid DNA in 18 minutes!

Streamlined Workflow

Product	Maximum Recovery	Elution Volume	Volume of *E. coli* Culture	Processing Time
ZymoPURE™ Midiprep Kit	300 µg	100-200 µl	50 ml	18 min.
ZymoPURE™ Maxiprep Kit	1200 µg	200-400 µl	150 ml	18 min.
ZymoPURE™ Gigaprep Kit	10 mg	2-5 ml	2.5 L	40-50 min.

Quick-DNA™ Universal Kit Get DNA from any sample!

Reliably isolate high-quality DNA from any sample source including biological fluids, cultured/monolayer cells, and solid tissues.

Product	Size	Catalog Number
Quick-DNA™ Universal Kit	50 Preps/200 Preps	D4068/D4069
Quick-DNA™ Universal 96 Kit	2 x 96 well/4 x 96 well	D4070/D4071

Quick-cfDNA™ Serum & Plasma Kit

High-quality DNA from up to 10 ml of serum & plasma

Product	Size	Catalog Number
Quick-cfDNA™ Serum & Plasma Kit	50 Preps	D4076

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