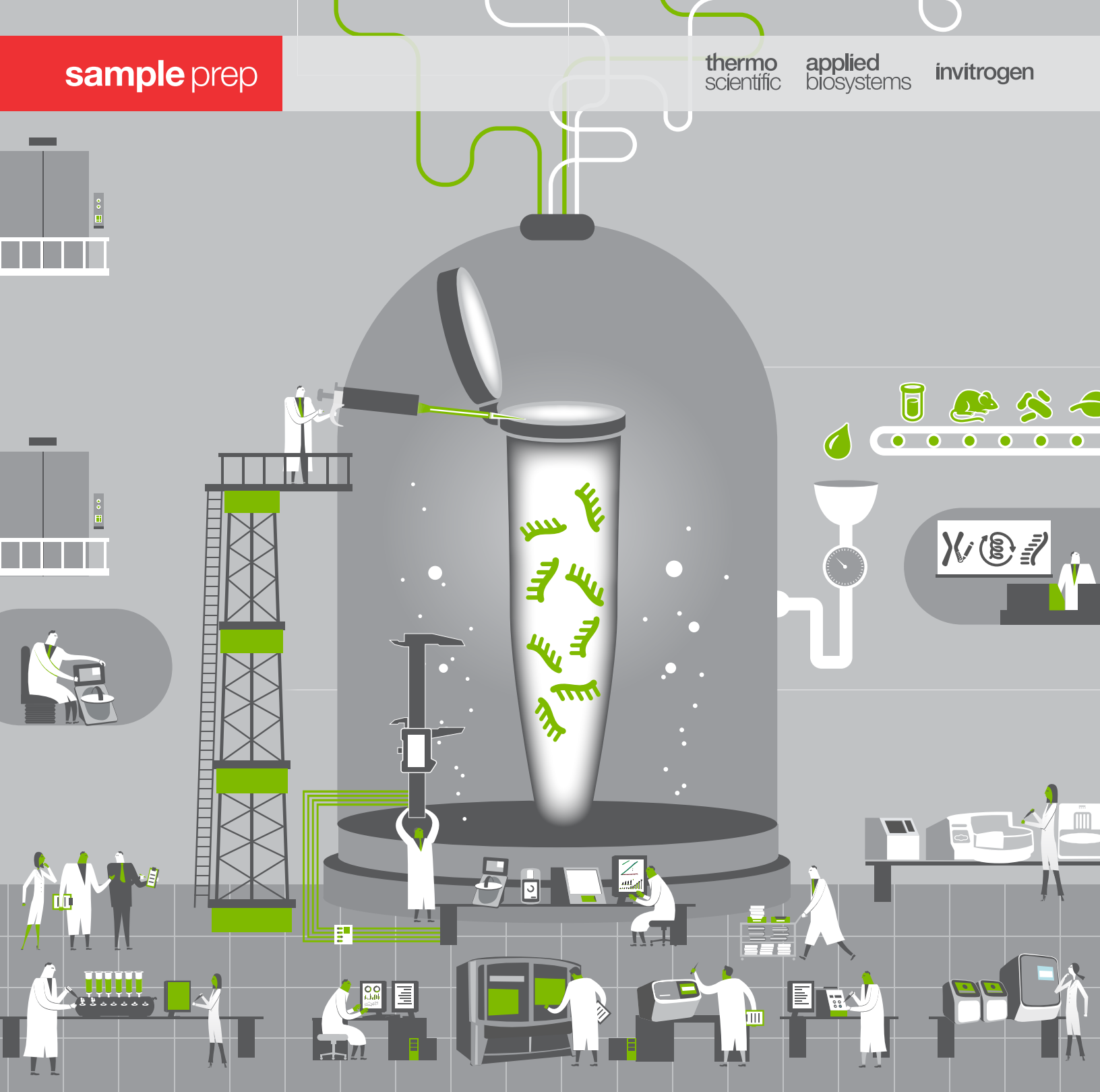


sample prep

thermo  
scientific

applied  
biosystems

invitrogen



# RNA isolation and purification

For every sample, RNA type, and application

**ThermoFisher**  
SCIENTIFIC



# Isolate and purify RNA with confidence

RNA isolation is a crucial step in your quest to understand gene expression levels. With all the solutions that Thermo Fisher Scientific has to offer, you can be confident that you're getting started on the right foot. Go ahead and push the limits of your research. We'll be there to support you with robust RNA purification kits, trusted RNA tools, and experienced technical support, all backed by nearly 30 years of leadership and innovation in RNA technologies.

- Isolate from any sample type, for any application
- Obtain high-purity, intact RNA
- Achieve high yields, even from small sample quantities



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# Methods of RNA isolation





For every application, sample, and RNA type

For over three decades, our scientists have developed innovative and robust RNA isolation products designed to make your job as a scientist easier. This effort is driven by our goal to provide unique and reliable products, services, and support to solve the problems you frequently face when working with RNA.

RNA isolation is a crucial step in the journey to discovery. Whichever downstream application you're attempting, you can be confident in our portfolio of high-quality products

and professional support. Our RNA isolation products include organic reagents, columns, sample lysate, and magnetic beads. Trusted products for RNA isolation include Applied Biosystems™ MagMAX™ kits; Invitrogen™ Cells-to-C<sub>T</sub>™, PureLink™, and *mirVana*™ kits; Invitrogen™ TRIzol™ Reagent; and Invitrogen™ Dynabeads™ isolation technologies. These solutions were developed to offer you maximum confidence in your results.

## Which product is right for your research?

Organic reagents	Columns	Cell lysate	Magnetic beads
 <p>High-purity organic extraction (requires alcohol precipitation)</p>	 <p>Fast, convenient silica column</p>	 <p>Chemical lysis (faster time-to-results in qRT-PCR)</p>	 <p>Scalable, flexible format with magnetic beads</p>
Product types			
<ul style="list-style-type: none"> <li>• TRIzol reagents</li> <li>• Invitrogen™ Phasemaker™ Tubes</li> </ul>	<ul style="list-style-type: none"> <li>• PureLink kits</li> </ul>	<ul style="list-style-type: none"> <li>• Fast Advanced Cells-to-C<sub>T</sub> kits</li> </ul>	<ul style="list-style-type: none"> <li>• MagMAX kits</li> <li>• Thermo Scientific™ KingFisher™ instruments</li> </ul>
<p>← Manual</p>		<p>Automated →</p>	

# RNA and sample types

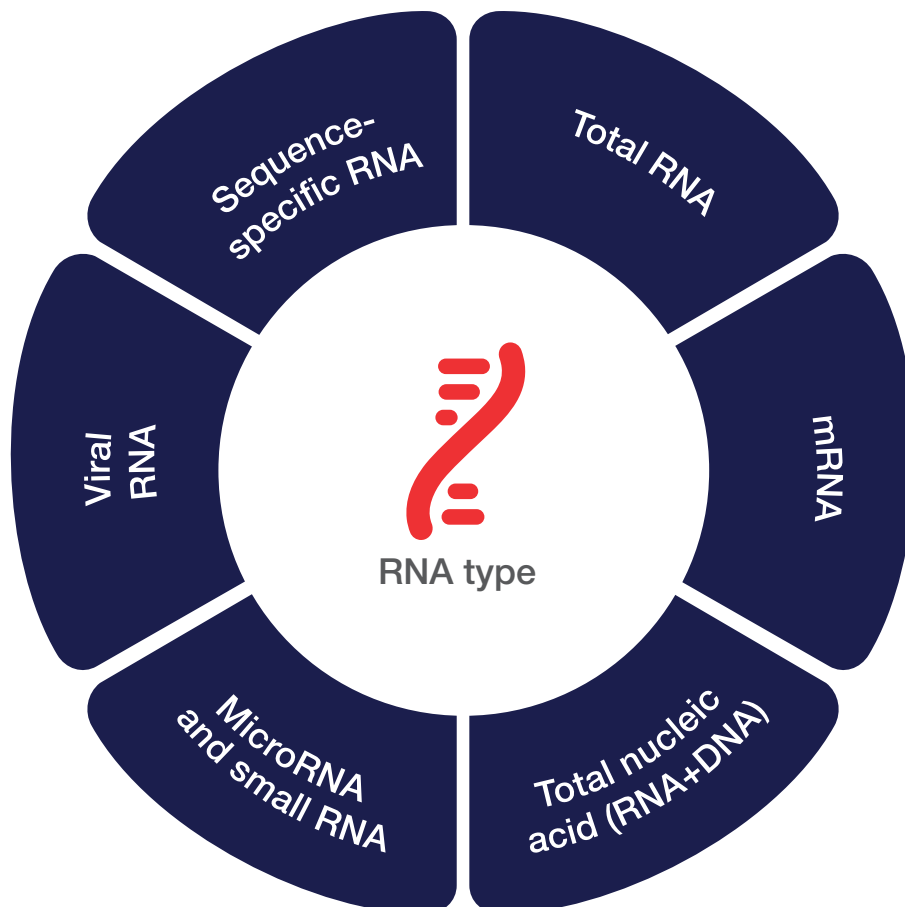
## RNA purification solutions

RNA isolation products include kits and reagents for purification of total RNA, messenger RNA (mRNA), microRNA (miRNA) and other small RNA species, and sequence-specific RNA. We also offer purified RNA, which can be used as a control in experiments. Our comprehensive portfolio of products provides scientists like you with the quality and performance required for analyzing gene expression mechanisms. Our full suite of products

is backed by professional scientists and engineers, and is designed for RNA isolation and purification from a wide range of sample types, throughputs, and input quantities.

Whether you're starting with cultured cells or tissue samples or you're working with plants, bacteria, or mammalian cells, we offer the right RNA purification kits and reagents for your needs.

### RNA type



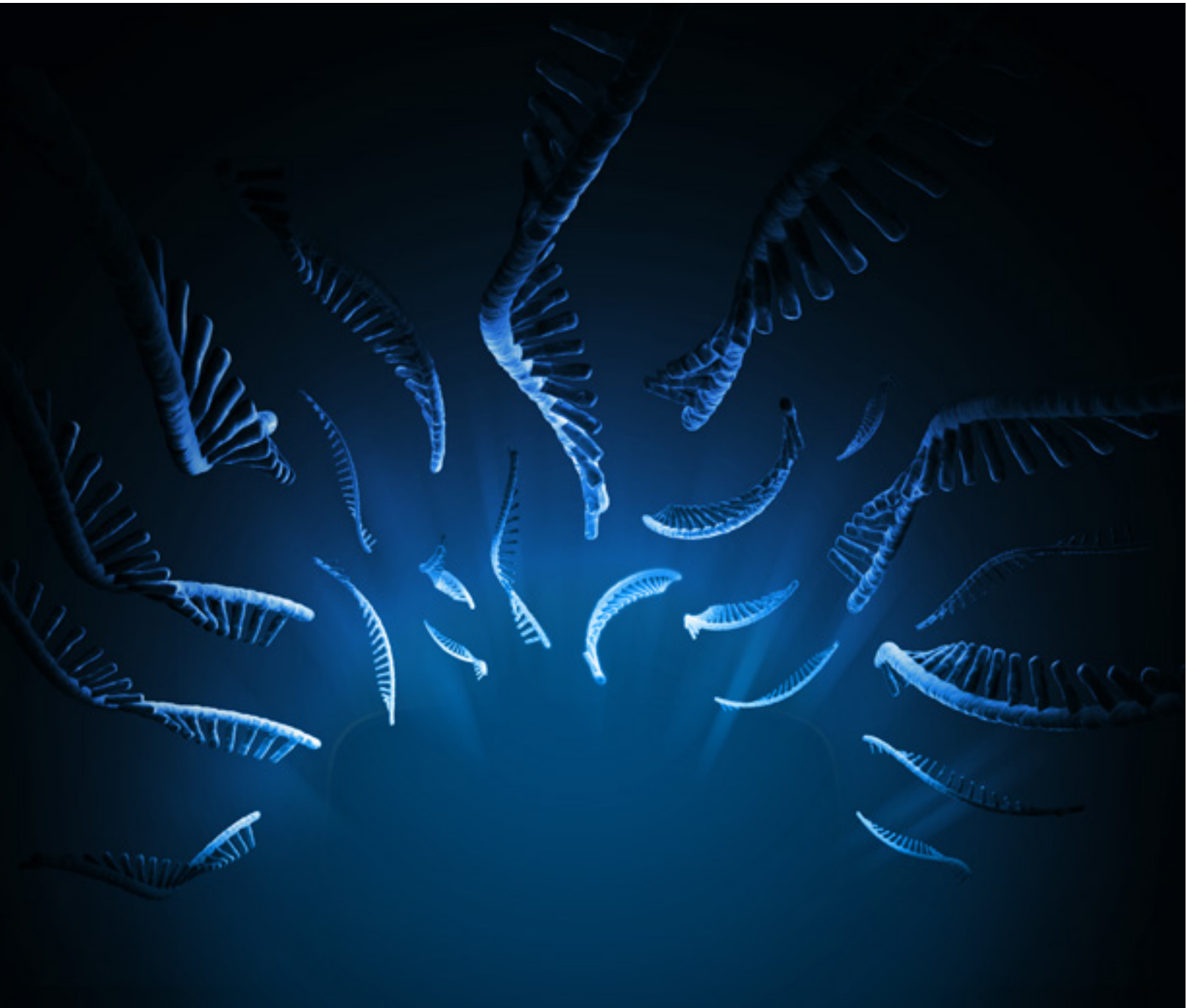
### Sample type

- Cells
- Tissue
- Plants
- Blood
- Viruses
- FFPE
- Yeast
- Exosomes
- Liquid samples
- Bacteria

# RNA applications

We provide multiple platforms for RNA analysis, such as real-time and digital PCR, next-generation sequencing, and microarrays for use in downstream applications such as:

- RNA structure and function
- RNA cloning
- Ribosomal RNA depletion
- *In vitro* transcription and translation
- Transcriptome analysis
- Biomarker discovery
- Differential gene expression





# Total RNA purification

Intact, high-quality RNA—simple, high-yield workflows

Starting with high-quality, pure, and intact total RNA is critical to many experiments, including RT-PCR, qRT-PCR, array analysis, northern blots, nuclease protection assays, and RNA sequencing. The table below will help you choose the right product to purify total RNA from your specific sample type and sample size.

View the complete portfolio at [thermofisher.com/totalrna](http://thermofisher.com/totalrna)

“... we optimized a co-extraction method using TRIzol Reagent, which is the most trusted reagent for total RNA extraction from fresh tissues, because it allows DNA/RNA phase separation and recovery from fresh tissues.”

Kotorashvili A et al. (2012) Effective DNA/RNA co-extraction for analysis of microRNAs, mRNAs, and genomic DNA from formalin-fixed paraffin-embedded specimens. *PLoS One* 7:e34683.

## Which product is right for your research?

	<b>TRIzol reagents</b>	<b>PureLink kits</b>	<b>MagMAX kits</b>	<b>Cells-to-C<sub>T</sub> kits</b>
	Process a large amount of tissue	Fast isolation of RNA from a variety of samples	High-throughput purification of RNA and DNA	Process cells for gene expression
<b>Prep time</b>	60 min	<20 min	45 min	10 min
<b>Sample types</b>	Most samples, particularly those more difficult to lyse	Bacteria, liquid, blood, cells, yeast, plants, tissue	Cells, blood, plants	Cultured cells
<b>Starting material</b>	100 mg of tissue or 10 <sup>7</sup> cells	108 cells; 200 mg of tissue, 250 mg of plant tissue, 0.2 mL of blood, 5 x 10 <sup>8</sup> yeast cells, 109 bacteria	100 mg of tissue or 5 x 10 <sup>6</sup> cells	1–100,000 cells
<b>Yield</b>	1 x 10 <sup>6</sup> epithelial cells; 8–15 µg, tobacco leaf; 70 µg (variable depending on sample)	Up to 350 µg	Variable depending on sample	NA
<b>High throughput-compatible</b>	No	Yes	Yes	Yes
<b>Technology</b>	Organic extraction	Silica membrane spin column/filter plate	Magnetic beads	Crude lysate

To use our online kit selection guide, go to [thermofisher.com/rnaselection](http://thermofisher.com/rnaselection)

# Organic RNA extraction

High-quality, intact RNA

## TRIzol Reagent

TRIzol products are ready-to-use reagents for the isolation of high-quality total RNA or the simultaneous isolation of RNA, DNA, and protein from a variety of biological samples. This monophasic solution of phenol and guanidine isothiocyanate is designed to isolate separate fractions of RNA, DNA, and proteins from cell and tissue samples of human, animal, plant, yeast, or bacterial origin, within one hour.

- Highly referenced reagent for preparing high-quality and intact RNA
- Cost-effective solution
- Ideal for difficult samples (e.g., fatty tissues, serum, viruses, bacteria)
- Single-step, monophasic solution (phenol and guanidine isothiocyanate)
- Alternate protocols to isolate DNA and proteins from the same sample
- Cat. Nos. 15596018, 15596026

To learn more and order, go to [thermofisher.com/trizol](https://www.thermofisher.com/trizol)





# Organic RNA extraction

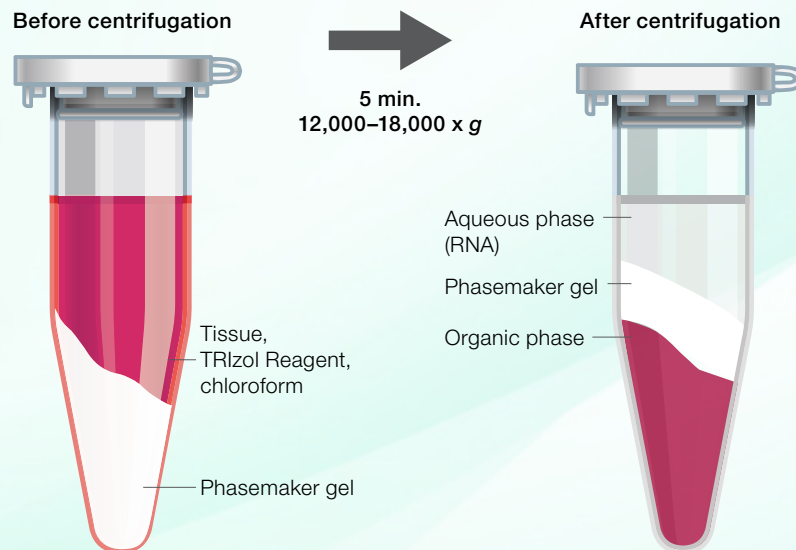
## TRIzol Reagent + Phasemaker Tubes

### TRIzol Reagent and Phasemaker Tubes

Phasemaker Tubes contain a thick liquid polymer that separates and completely isolates the upper aqueous phase of the TRIzol reagent mix from the organic phase underneath, greatly simplifying the recovery of the upper phase containing the RNA even if the tubes are shaken, dropped, or bumped.

- **Ready to use**—predispensed into 2 mL tubes for everyday RNA extraction using TRIzol Reagent
- **High yield**—increase recovery by as much as 30%

- **Convenient**—simply use with TRIzol Reagent; mix, centrifuge, then easily pipette off the aqueous phase
- **Inert**—does not compromise RNA integrity or downstream experiments (e.g., qPCR)
- Available as Phasemaker Tubes alone or in the Phasemaker™ Tubes Complete System with TRIzol, TRIzol LS, or TRIzol Plus Reagent



# Spin column RNA isolation

Flexible, easy to use, and reliable

## RNA spin columns

The Invitrogen™ PureLink™ RNA Mini Kit provides a simple, reliable, and rapid column-based method for isolating high-quality total RNA from a wide variety of sources without the need for hazardous reagents such as phenol. Obtain high-yield, high-integrity RNA from animal and plant cells and tissues as well as blood, bacteria, yeast, and liquid samples.

- The “go-to” method for everyday RNA applications
- Fast, 20-minute protocols
- Maximum sample input capacity (up to 200 mg tissue;  $5 \times 10^8$  cells)
- Column binding capacity allows for higher RNA yield recovery (up to 1,000 µg of total RNA)
- Available for total RNA, mRNA, total nucleic acid, miRNA, small RNA, viral RNA, and sequence-specific RNA extractions

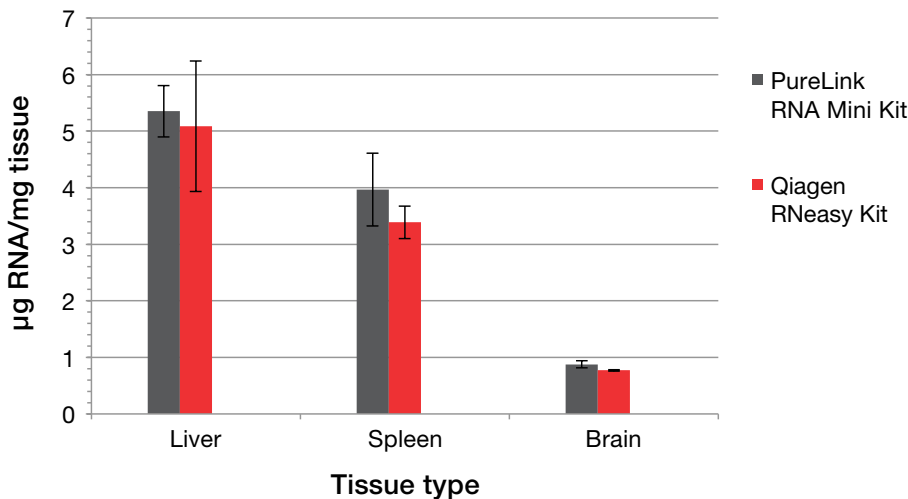
## RNA purification



Invitrogen™ silica columns  
1,000 µg binding capacity



Supplier Q silica columns  
100 µg binding capacity



**Figure 1. Yield comparison from various samples.** Total RNA samples from rat liver, spleen, and brain tissues were purified using the PureLink RNA Mini Kit and Qiagen™ RNeasy™ Kit according to the manufacturer’s instructions. In each case, the PureLink RNA Mini Kit provided yields equivalent to or better than the Qiagen kit.

Looking to isolate RNA from small quantities of samples? The Invitrogen™ PureLink™ RNA Micro Scale Kit provides rapid purification of RNA from limited sample quantities like LCM tissues, fine-needle aspirates, and FACS-sorted cells.

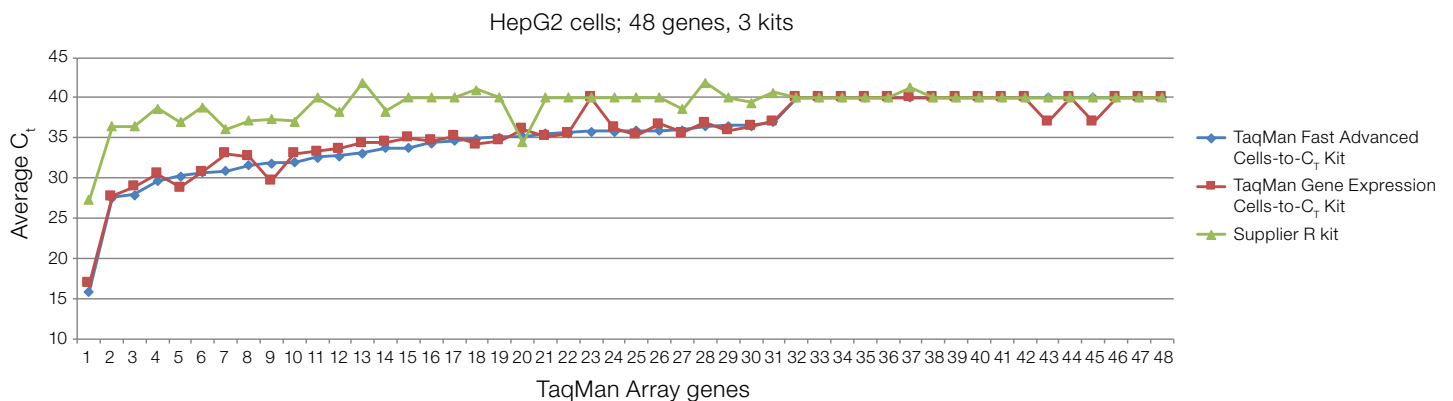
# Lysate-based RNA extraction

Exceptional speed and accuracy in measuring gene expression

## Cells-to- $C_T$ kits

The Invitrogen™ TaqMan® Fast Advanced Cells-to- $C_T$ ™ Kit offers:

- The same patented lysis solution and stop solution as the original TaqMan Gene Expression Cells-to- $C_T$  Kit
- Extraordinary ease and speed—96 samples for RT-qPCR in typically <10 min
- No tedious RNA purification—no columns, heating, centrifugation, or sample transfer
- Detect virtually any gene product with more than 2 million predesigned assays



**Figure 2. Gene expression analysis in HepG2 cells.** Following each kit's protocol,  $10^4$  cells were lysed. The maximum amount of lysate was added to each kit's RT (45% for Cells-to- $C_T$  and Fast Advanced Cells-to- $C_T$  kits; 10% for other supplier). Then 25% of RT was added into the qPCR reactions of a TaqMan Array for phosphodiesterases, using each kit's qPCR master mix. The Fast Advanced Cells-to- $C_T$  kit performed better than the original Cells-to- $C_T$  kit ( $C_T$  earlier by 0.5 cycle, on average) and another supplier's kit (earlier by 3.6 cycles, translating to 11x better sensitivity).

To learn more and order, go to [thermofisher.com/cellstoc](https://www.thermofisher.com/cellstoc)

# Automated RNA purification

## Highly versatile, adaptable, and flexible system

Optimize and automate your RNA purification workflow with MagMAX kits and Thermo Scientific™ KingFisher™ Flex and Duo Prime Purification Systems. A revolutionary particle separation technology—permanent magnetic rods and disposable tip combs with independent movement

control—forms the basis of both KingFisher Flex and KingFisher Duo Prime instruments. When used with compatible bead-based reagents such as MagMAX kits, these processors enable versatile automation of DNA and RNA extraction, isolation, and purification procedures.

## High-throughput automated purification with the KingFisher Flex Purification System

Using a carousel of eight plate positions, the KingFisher Flex instrument is designed to process washing, incubation, and bead transfer steps with entire plates of samples from a variety of sources.




- For 24 large-volume or 96 standard-volume samples
- High-throughput sample processing
- Volume ranges from 50 to 5,000  $\mu\text{L}$
- 24-tip and 96-tip manifold (for 24-well and 96-well plates)
- Accommodates up to 8 plates



In addition to total RNA purification, KingFisher processors can accommodate DNA, protein purification, and cell separation.

Learn more and request a demo at [thermofisher.com/kingfisher](https://thermofisher.com/kingfisher)

## Thermo Scientific™ automated sample preparation technologies comparison chart

	KingFisher Duo Prime Purification System	KingFisher Flex Purification System	KingFisher Presto Purification System
			
<b>Benefits</b>	An economical option for automated nucleic acid purification and protein purification from up to 12 samples at a time and 24 samples per load using magnetic beads	A highly versatile and reproducible purification of 24 or 96 samples per run	Utilizes magnetic particle-based technology to provide high-quality yields of target nucleic acids and proteins; compatible with a liquid handler for plate filling in high-throughput laboratories
<b>Applications</b>	DNA and RNA isolation from various starting materials; proteomic applications; cell isolation	DNA and RNA isolation from various starting materials; proteomic applications; cell isolation	Nucleic acid purification, protein purification, immunoprecipitation, antibody purification, phosphopeptide enrichment, phage display
<b>Reagents</b>	Preloaded and user-editable MagMAX kits available to support tissue, cell, blood, FFPE, bacterial, buccal, plant, and viral samples, as well as liquid (e.g., serum)		
<b>Protocol</b>	Uses Thermo Scientific™ BindIt™ Software or USB memory device	Uses BindIt Software	Uses BindIt Software
<b>Plastic consumables</b>	96 deep-well plate 24 deep-well plate 1 x 12 elution strip	96 deep-well plate 24 deep-well plate 96-well plate	96 deep-well plate 24 deep-well plate 96-well plate
<b>Sample input volume</b>	30–1,000 µL (12-pin magnet head) 200–5,000 µL (6-pin magnet head)	50–1,000 µL, 96 deep-well plate 200–5,000 µL, 24 deep-well plate 20–200 µL, 96-well plate	50–5,000 µL 24- or 96-head magnets
<b>Throughput</b>	Up to 12 samples with 12-pin magnet head Up to 6 samples with 6-pin magnet head	1 to 24 samples (24-well plate) 1 to 96 samples (96-well plate)	1 to 24 samples (24-well plate) 1 to 96 samples (96-well plate)
<b>Instrument dimensions (W x D x H)</b>	40 x 46 x 34 cm (15.7 x 18.1 x 13.4 in.)	68 x 60 x 38 cm (26.8 x 23.6 x 15 in.)	36 x 46.5 x 40 cm (14.2 x 18.3 x 15.5 in.)
<b>Weight</b>	17 kg (37.5 lb)	28 kg (62 lb)	24 kg (53 lb)

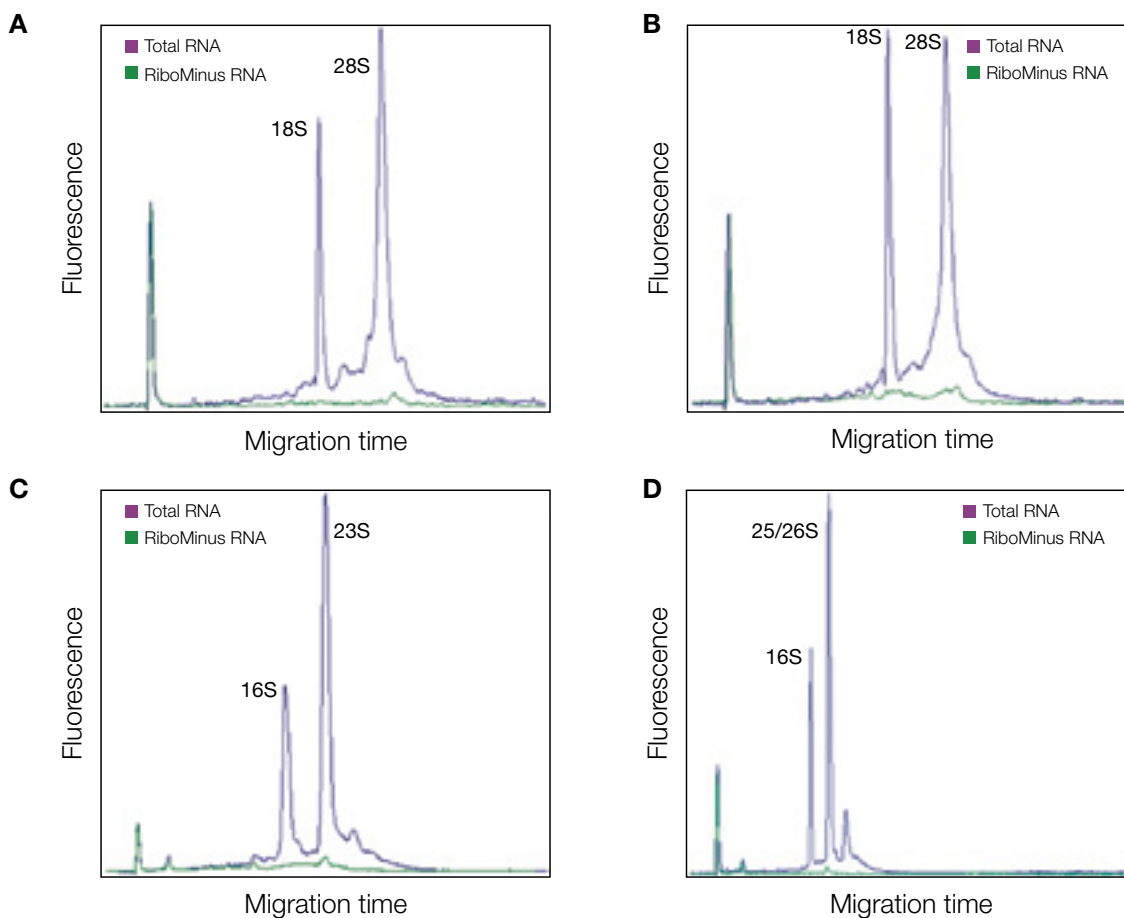
# Transcriptome purification

A comprehensive, truly representative spectrum of RNA transcripts

Isolating high-quality RNA is a crucial first step in successful whole-transcriptome analysis. Transcriptome enrichment and concentration prepare the sample for numerous downstream applications, including RNA-Seq, microarray analysis, library construction, and qRT-PCR.

Invitrogen™ RiboMinus™ Transcriptome Isolation Kits enrich RNA transcripts by depleting large ribosomal RNA (rRNA) molecules from the total RNA sample. This unique technology offers:

- Ribosomal RNA-free, whole-transcriptome samples
- Increased representation of RNA transcript species
- Variety of sample formats (human, mouse, yeast, and bacterial)



**Figure 3. RiboMinus technology demonstrating greater than 95% rRNA depletion.** (A) Human total RNA isolated from HeLa cells. (B) Mouse total RNA isolated from mouse liver. (C) Bacterial total RNA isolated from *E. coli*. (D) Yeast total RNA isolated from *S. cerevisiae*. Samples were analyzed using the Agilent™ 2100 Bioanalyzer™ instrument.



# mRNA purification

## Rapid, high-yield isolation of pure mRNA

Only 1–5% of the total RNA in a typical mammalian cell is poly(A) RNA or mRNA.

We offer highly efficient technologies to purify mRNA directly from your starting sample or from isolated total RNA. The table below will help you choose the technology that is right for you.

### Which mRNA purification product is right for your research?

	Dynabeads mRNA Purification Kit	Dynabeads mRNA DIRECT Purification Kit	Dynabeads mRNA DIRECT Micro Kit	mRNA Catcher PLUS Purification Kit
	Rapid mRNA purification from total RNA	No purification, mRNA direct from crude samples	mRNA from micro-sized samples	High-throughput mRNA directly or enriched from total RNA
Prep time	15 min	15 min	15 min	90 min
Isolation from crude samples	No	Yes	Yes	Yes
Enrichment from total RNA	Yes	No	No	No
Sample type	Total RNA	Liquid, RNA, FFPE, yeast, blood, tissue, virus, plant, cells	Liquid, RNA, FFPE, yeast, blood, tissue, virus, plant, cells	Total RNA, blood, mammalian tissue, cells
Starting material	75 µg of total RNA	2 x 10 <sup>7</sup> cells, 2–200 mg of tissue, 4–400 mg of plant	1 x 10 <sup>4</sup> cells, 5 mg of tissue or plant	100 to 1 x 10 <sup>6</sup> cells, 4 mg of tissue, 40 µL of whole blood, 100 ng–100 µg of total RNA
High throughput-compatible	Yes	Yes	Yes	Yes
Technology	Magnetic beads	Magnetic beads	Magnetic beads	Oligo(dT) affinity

### Two distinct approaches to purifying mRNA

- Extract total RNA, then enrich for mRNA. This allows for archiving of total RNA samples and is the method used with the Invitrogen™ mRNA Catcher™ PLUS Purification Kit.
- Lyse the cells, then purify mRNA directly. This is typically faster than the first approach and is the method used with Invitrogen™ Dynabeads™ mRNA DIRECT™ kits.

Dynabeads mRNA purification has been cited in over 5,000 publications.



#### Did you know?

Your mRNA purification workflow can be automated on a KingFisher magnetic particle processor. Find out more at [thermofisher.com/kingfisher](https://thermofisher.com/kingfisher)

# MicroRNA and small RNA purification

## Rapid, quantitative recovery of small RNA

MicroRNA and other small RNAs have a substantial impact on biological processes, including gene expression. However, traditional RNA isolation methods do not sufficiently recover these smaller RNAs. Our RNA specialists have developed RNA isolation kits that enable rapid, quantitative recovery of small RNAs from a variety of sample types in as little as 10 minutes. The table below will help you choose the right product to purify small RNAs for your specific application.

### The high throughput-capable Applied Biosystems™ MagMAX™ *mirVana*™ Total RNA Isolation Kit enables superior miRNA analysis

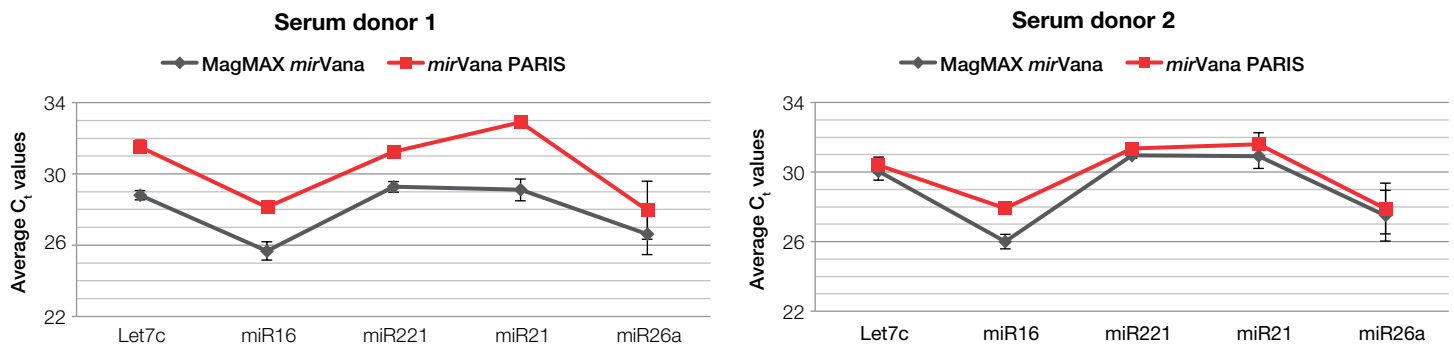


Figure 4. RNA was isolated from the serum of two donors and the levels of five microRNAs were measured by qRT-PCR. The MagMAX *mirVana* Total RNA Isolation Kit, a magnetic bead-based technology, was benchmarked against the Invitrogen™ *mirVana*™ PARIS™ RNA Kit.

### Which product is right for your research?

	<i>mirVana</i> miRNA Isolation Kit	MagMAX <i>mirVana</i> Total RNA Isolation Kit	TaqMan microRNA Cells-to-C <sub>t</sub> Kit
	30 min isolation from most samples	High-throughput, pure, concentrated microRNA	Complete kit, sample to qPCR from cells
Prep time	30 min	<60 min	10 min
Sample types	Bacteria, cells, yeast, plant, tissue, virus	Plasma/serum, whole blood, tissue, cells, urine	Cells
Starting material	250 mg of tissue or 10 <sup>7</sup> cells	100 mg of tissue or 5 x 10 <sup>6</sup> cells	10–100,000 cells
High throughput-compatible	No	Yes	Yes
Technology	Organic extraction and silica membrane spin column	Magnetic beads (phenol-free)	Crude lysate



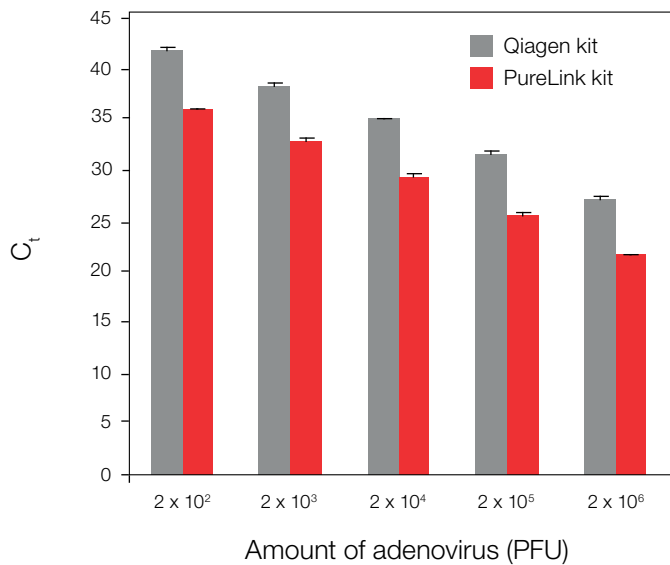
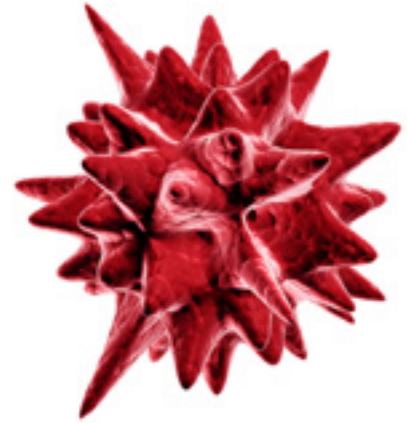
# Viral RNA purification

## Rapid, efficient purification from biological fluids

Successful viral analysis starts with the isolation of highly pure, concentrated viral RNA and DNA. Our advanced nucleic acid purification technologies for isolation of viral nucleic acids from biological (animal, insect, plant, fungal, and bacterial) and environmental (water, air, and food) samples give you confidence in your sensitive downstream real-time PCR and sequencing.

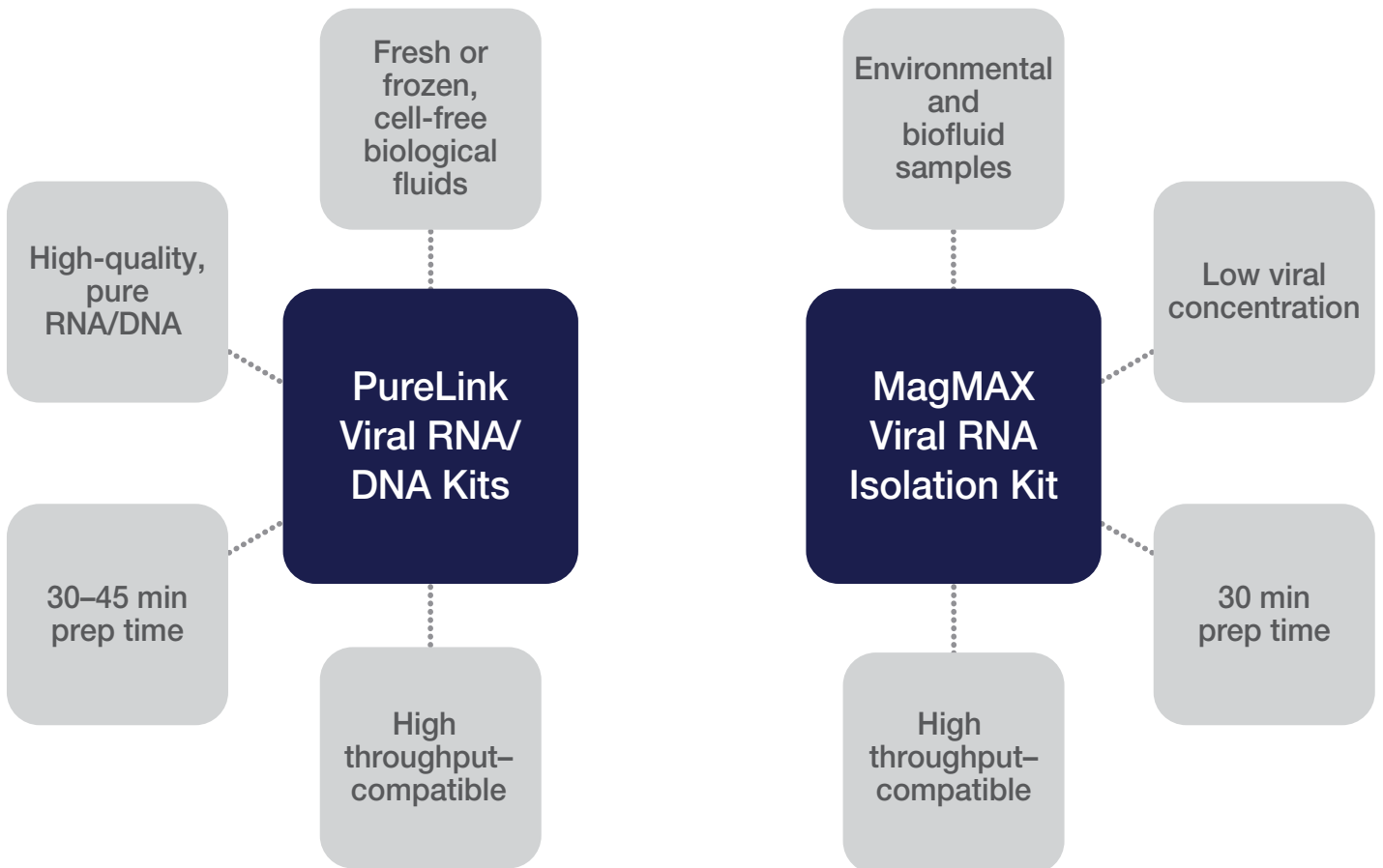
Our viral nucleic acid isolation technologies offer:

- Superior recovery—even at low concentrations
- High sensitivity and reproducibility
- High-throughput compatibility and integration into robotic platforms



**Figure 5. Reliable recovery of viral nucleic acid using the PureLink Viral DNA/RNA Mini Kit.** Serum samples (200  $\mu$ L) were spiked with adenovirus DNA in a range of amounts. The PureLink kit and a comparable Qiagen kit were used to extract the viral DNA, which was subsequently quantitated by qPCR.





View all our tools for viral RNA and DNA capture and purification as well as qRT-PCR and qPCR analysis at [thermofisher.com/viral](https://www.thermofisher.com/viral)

Select the right viral RNA isolation kit for your research at [thermofisher.com/viralrna](https://www.thermofisher.com/viralrna)

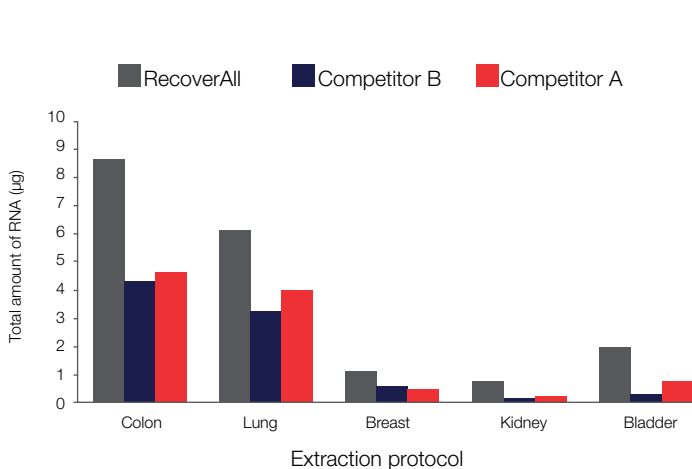
# RNA from FFPE samples

## Sequential RNA and DNA isolation

### Column-based isolation

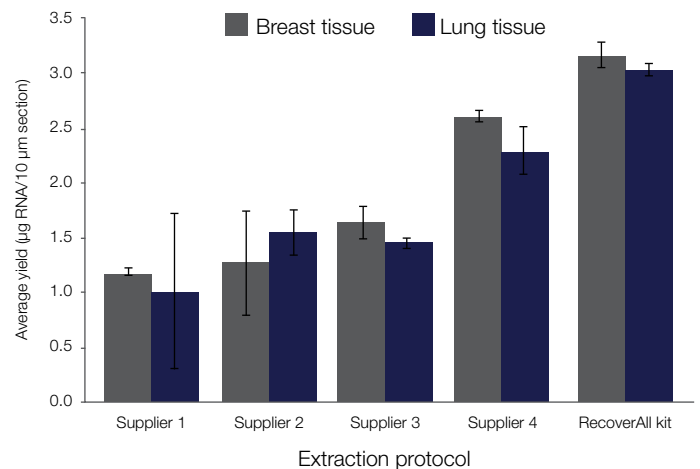
#### Multi-sample RNA/DNA isolation

Archived tissue samples contain valuable information of disease states. Standard preservation techniques trap nucleic acids and modify them through protein–protein and protein–nucleic acid crosslinks. RNA (and to some extent, DNA) is often quite fragmented and chemically modified, making it incompatible with molecular analysis. RNA fragmentation in FFPE tissues cannot be reversed; however, the protease digestion conditions of the Invitrogen™ RecoverAll™ kit are designed to release a maximal amount (see Figure 7) of trapped RNA fragments of all sizes, including microRNA, in a relatively short amount of time.



**Figure 6. Yield of RNA from archived human FFPE tissue samples: the RecoverAll kit vs. two competitor systems.** A 10–20 µm section from each of the above archived human tissue blocks was isolated using each of three kits: Competitor A kit, Competitor B kit, and the RecoverAll kit. Colon, lung, and breast samples were 1–2 years old; kidney samples were 3–5 years old; and bladder samples were 10–15 years old. Once the RNA was isolated, the concentration was determined via OD<sub>260</sub> and the amount of RNA recovered in µg was calculated. The RecoverAll kit yielded the highest recovery of the three systems for all tissue types.

The RecoverAll multi-sample RNA/DNA workflow is complete for sequential extraction of RNA and DNA from the same sample. The recovered RNA and DNA are ready for use with downstream applications such as quantitative real-time RT-PCR and targeted sequencing, which are compatible with the Ion Torrent™ OncoPrint™ Cancer Research Panel.



**Figure 7. The RecoverAll kit provides the highest RNA yield from FFPE tissue.** RNA was extracted in duplicate from two distinct six-year-old FFPE tumor tissues, using five different protocols. The RecoverAll kit protocol resulted in the highest yields.

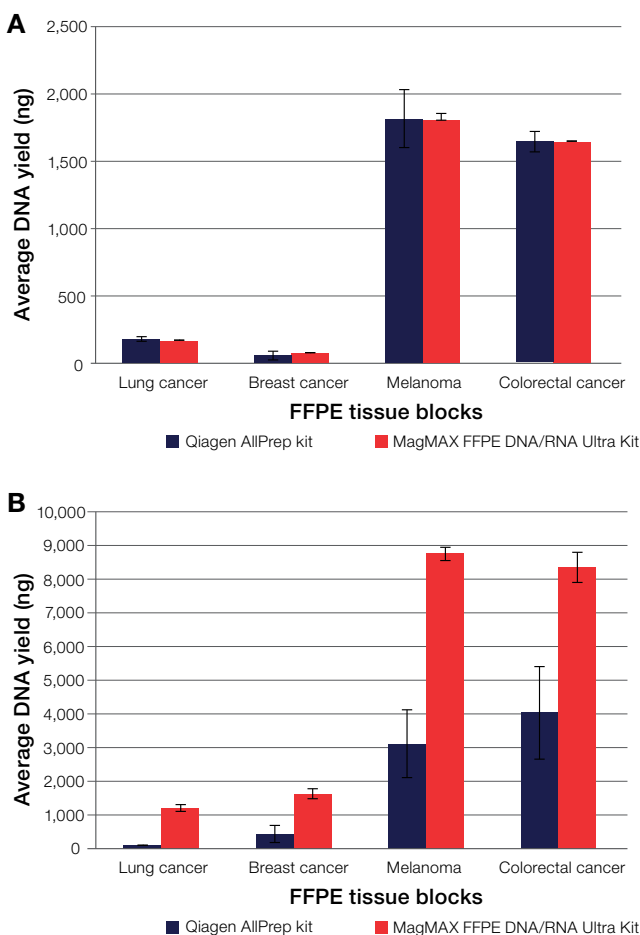


## Bead-based isolation

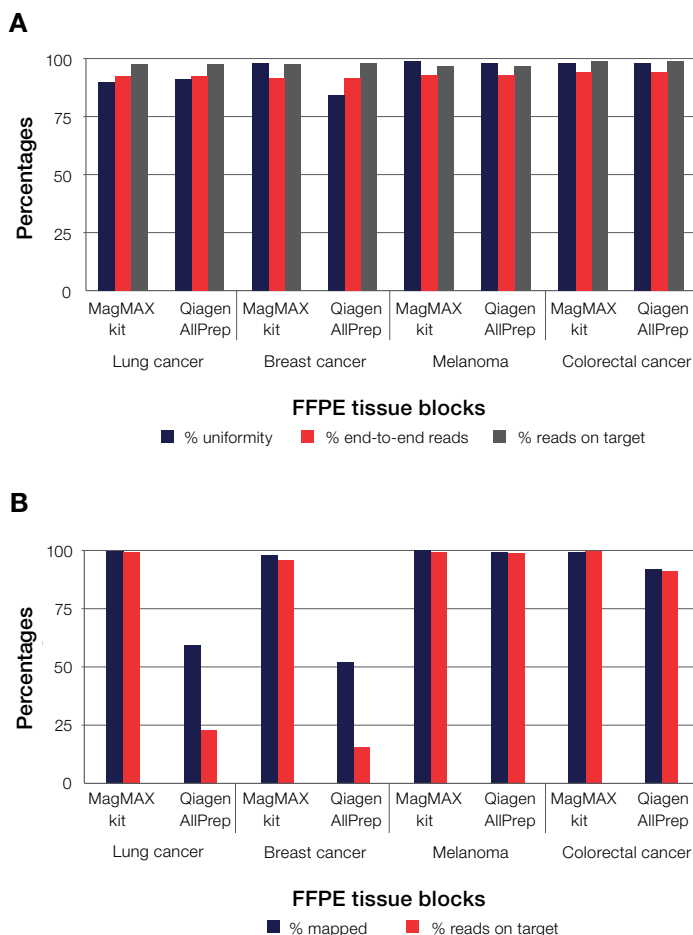
The magnetic bead-based technology in the Applied Biosystems™ MagMAX™ FFPE DNA/RNA Ultra Kit allows sequential isolation of DNA and RNA from the same formalin-fixed, paraffin-embedded (FFPE) tissue sample (Figure 8). Recovering both DNA and RNA (including microRNA) from the same sample enables analysis and comparison of all the important biomarkers contained within your sample, such as hotspot mutations, copy

number variations, gene fusions, and indels. The DNA and RNA are recovered in separate eluates—and both are compatible with a broad range of applications, including real-time PCR and next-generation sequencing (Figure 9).

The MagMAX FFPE DNA/RNA Ultra Kit uses a simple, fast protocol that may be performed manually or automated on KingFisher purification systems.



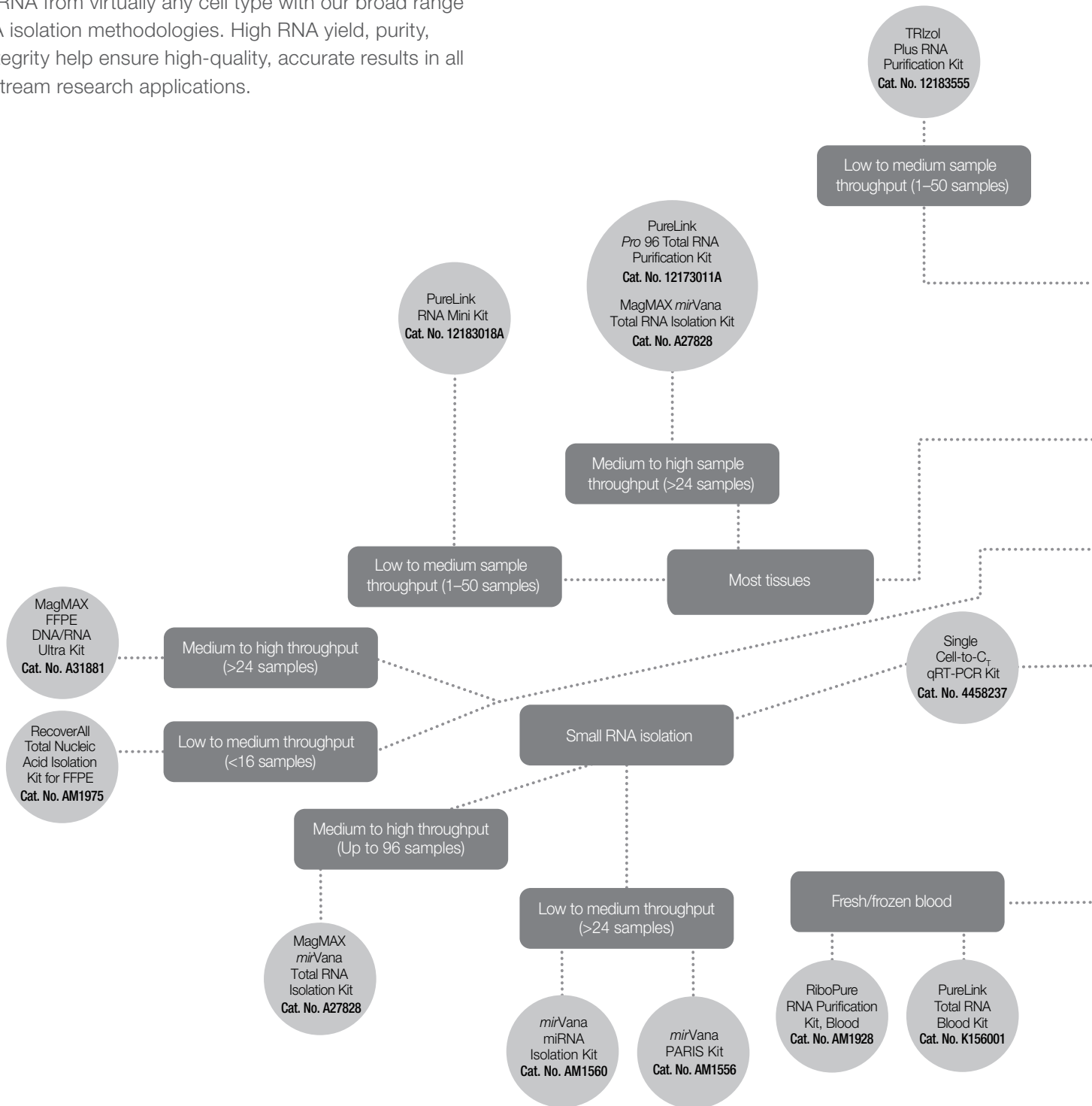
**Figure 8. The MagMAX FFPE DNA/RNA Ultra Kit provides superior RNA yields.** DNA and RNA from consecutive 1 x 5 μm sections of four FFPE cancer tumor resection blocks were isolated with the MagMAX FFPE DNA/RNA Ultra Kit on the KingFisher Flex Purification System, and with the Qiagen AllPrep kit. Samples were quantitated with Invitrogen™ Quant-iT™ DNA and RNA assay kits for (A) DNA and (B) RNA yield.

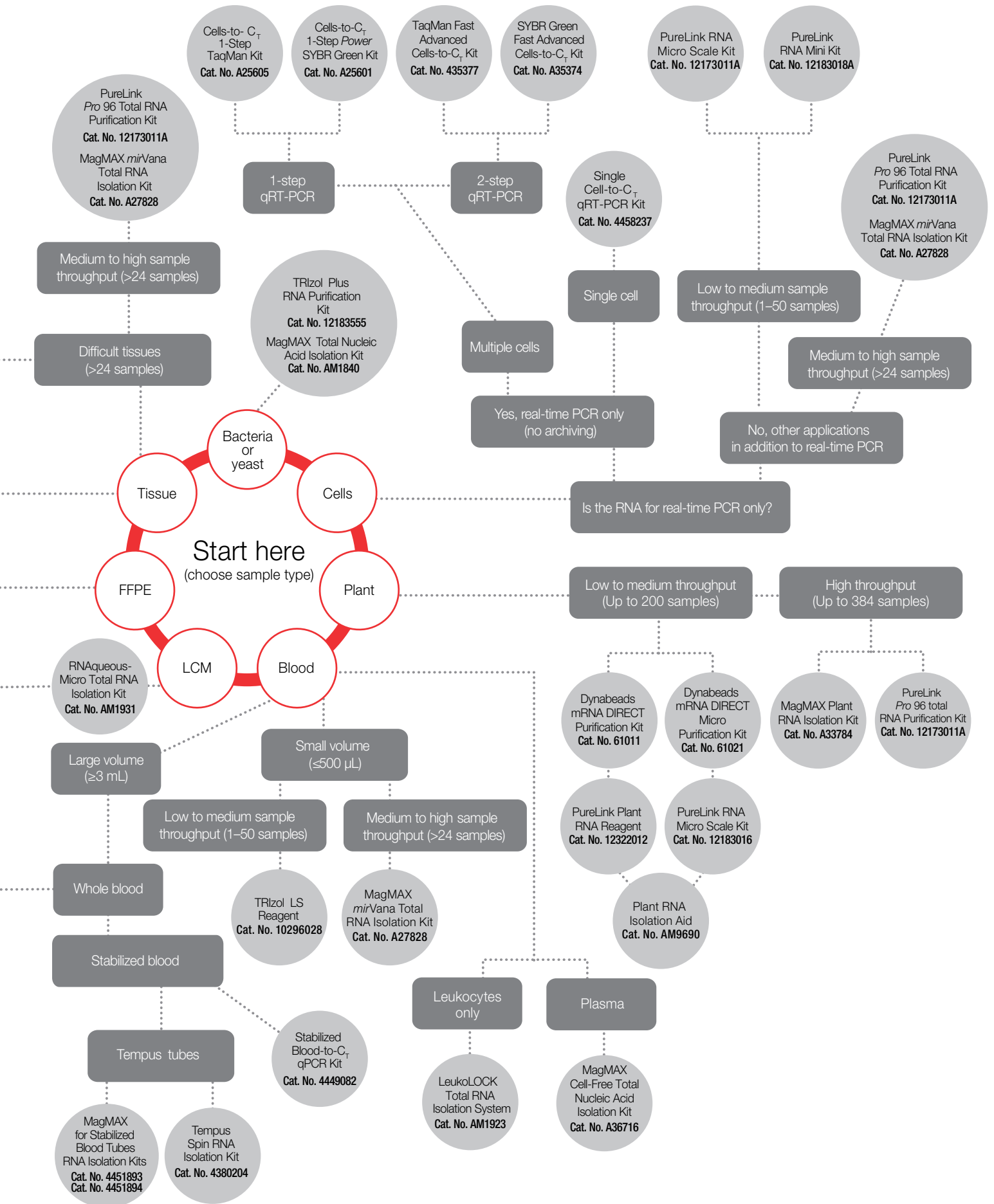


**Figure 9. The MagMAX FFPE DNA/RNA Ultra Kit provides comparable or better sequencing results.** The MagMAX FFPE DNA/RNA Ultra Kit and the Qiagen AllPrep kit were used to isolate DNA and RNA from the same FFPE sections. (A) DNA and (B) RNA libraries were created using the Ion AmpliSeq™ Cancer Hotspot Panel v2, prepared using the Ion Chef™ System, and sequenced using the Ion PGM™ System. Data were analyzed using Torrent Suite™ Software.

# RNA isolation technology guide

Purify RNA from virtually any cell type with our broad range of RNA isolation methodologies. High RNA yield, purity, and integrity help ensure high-quality, accurate results in all downstream research applications.





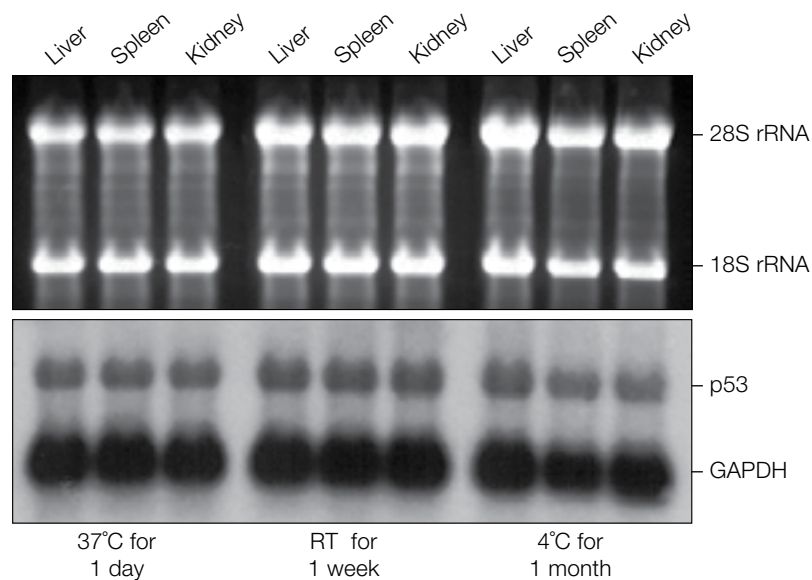
# RNA lab essentials

## For avoiding, detecting, and inhibiting RNases

RNA can be difficult to work with because it is readily degraded by RNases that are found in a variety of sources, such as bacteria and fungi, as well as flaked skin and hair. RNases are extremely robust enzymes that can retain functionality, even after freeze/thaw cycles and autoclaving. Consequently, RNases are unaffected by many methods of decontamination, and strong chemical methods are often required to eliminate them from surfaces and solutions.

However, some basic precautions, such as using RNase-free plastics and reagents, maintaining a clean work surface, and properly stabilizing tissue samples prior to storage will go a long way toward minimizing experimental inconsistencies and failures. Invitrogen™ RNA essentials are a staple in labs that handle RNA, giving researchers confidence in their results.

Even tissue from the spleen, an organ known for its high endogenous RNase content, can be stored without jeopardizing the quality or quantity of RNA subsequently isolated when the sample is stabilized with Invitrogen™ RNA/*later*™ Stabilization Solution.



**Figure 10. Northern blot of RNA from tissue treated with RNA/*later* Stabilization Solution.** The dissected tissue was submerged in approximately 5 volumes of RNA/*later* solution at room temperature. Samples were stored at 37°C for one day, room temperature (25°C) for one week, or 4°C for one month. A northern blot (of gel in the top panel) that was hybridized with probes to p53 and GAPDH demonstrates the integrity of RNA isolated from tissues treated with RNA/*later* solution and stored at different temperatures (bottom panel).



### **Nuclease-free tips and tubes**

Pipette tips and tubes are an easily overlooked source of RNase contamination.

We offer a range of RNase-free plastic pipette tips, PCR tubes, microcentrifuge tubes, and conical tubes. Each lot of Invitrogen™ tips and tubes undergoes rigorous testing and is certified to be nuclease-free. View products at [thermofisher.com/nucleasefreeplastics](https://www.thermofisher.com/nucleasefreeplastics)



### **Nuclease-free water**

Preparing reagents and resuspending precipitated RNA with water of the appropriate grade is a crucial and often-ignored first step for consistent experimental results. Even purified water can have a high pH and minerals that can interfere with certain types of reactions.

We offer several grades of nuclease-free water—diethylpyrocarbonate (DEPC)-treated water, nuclease-free water (not DEPC-treated), and RT-PCR-grade water—all rigorously tested for contaminating nonspecific endonuclease, exonuclease, and RNase activity. Learn more at [thermofisher.com/nucleasefreewater](https://www.thermofisher.com/nucleasefreewater)



### **Surface decontamination**

It's safe to assume that most laboratory surfaces are contaminated with RNases, since they're exposed to the bacteria, fungi, flaked skin, and hair present in the environment. Unfortunately, even trace quantities of RNases can lead to lower yields from *in vitro* transcription reactions, degradation during RNA purification protocols, and variable results with qRT-PCR.

Fortunately, a suite of trusted products proven effective at eliminating RNase contamination from lab surfaces is available, including Invitrogen™ RNaseZap™ RNase Decontamination Solution and Invitrogen™ RNase AWAY™ Decontamination Reagent. View and order all solutions at [thermofisher.com/surfacedecontamination](https://www.thermofisher.com/surfacedecontamination)



### **Sample stabilization**

In order to isolate high-quality RNA, the tissue has to be either processed immediately after harvest, snap-frozen, or stabilized in an intermediary solution to preserve RNA integrity and allow for storage.

We offer several Invitrogen™ RNAlater™ products designed specifically to stabilize and preserve the quality of RNA either at the point of collection or even post-collection. Learn more at [thermofisher.com/stabilizeRNA](https://www.thermofisher.com/stabilizeRNA)

# Avoiding RNA degradation

## Obtain high-quality and intact RNA

RNases, the enzymes that degrade RNA, are among the most stable of known enzymes. They are abundant in most environments, including on human hands. Here are a few tips to help avoid RNA degradation in your sample:

- Always wear gloves when working and also remember to change your gloves if you accidentally touch skin or any other contaminated surface
- Use RNase-free plastics such as tubes and pipette tips
- If glassware is used, autoclaving is not enough—glassware must be baked for several hours at temperatures greater than 180°C or treated with a reagent such as one of the RNaseZap products
- If preparing buffers, use water that is nuclease-free or treated with DEPC like Invitrogen™ nuclease-free water (Cat. No. AM9930)
- Set up designated RNA work areas that have low traffic and are away from air vents and research involving body fluids or tissue, which introduce RNase contamination
- Protect your samples with reagents such as RNAlater Stabilization Solution, or store them at –80°C in the presence of an RNase-free buffer

To learn more and order, go to [thermofisher.com/rnabasics](https://www.thermofisher.com/rnabasics)



# Tips for handling RNA

## Protect your RNA



### Phenol extraction

This technique removes proteins from nucleic acid samples during isolation, and purifies nucleic acids after enzymatic reactions (e.g., removal of restriction enzymes during preparation of transcription template).



### Ethanol wash

Ethanol washes are performed after salt/EtOH precipitations to remove any residual salt from the nucleic acid pellet. The wash employs 70–80% EtOH, which will solubilize salts but not nucleic acids.



### Double aspiration

This method removes for removing the last traces of EtOH supernatant after precipitations. It involves a second quick spin and aspiration to ensure removal of any precipitation supernatant (e.g., on the walls of the tube) that might interfere with downstream steps of the protocol.



### Resolubilizing RNA pellets

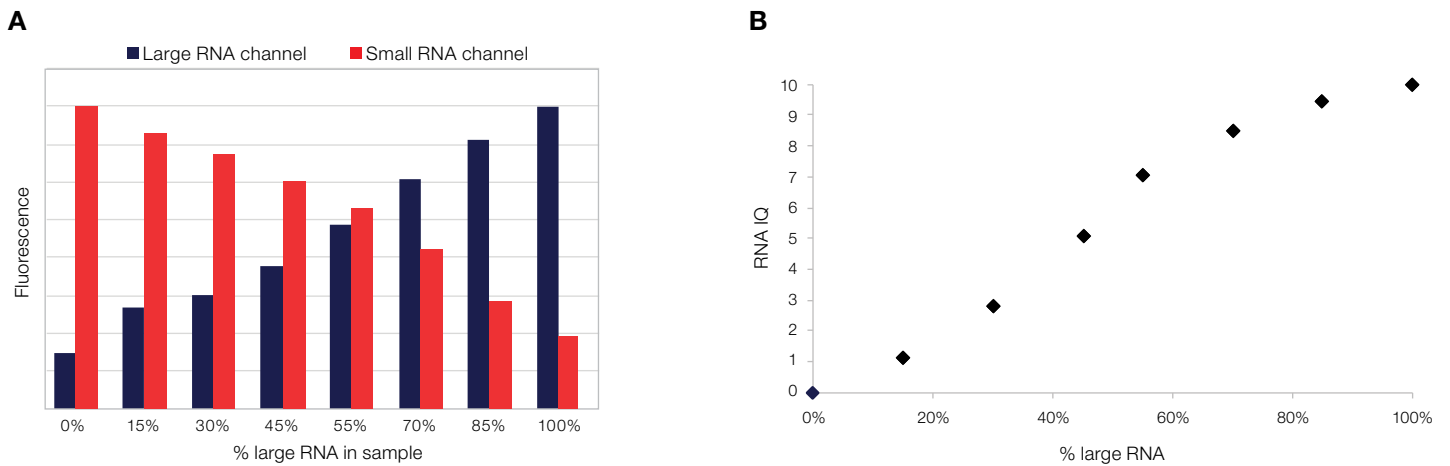
During RNA isolations and purifications, it is often necessary to precipitate the sample. Resolubilizing the RNA pellet after precipitation can be time-consuming, and the presence of proteins or other contaminants can make it difficult. Use the largest volume of solute possible to increase solubility. Pellets that are less dry may be easier to solubilize.

To learn more and order, go to [thermofisher.com/rnahandlingtips](https://thermofisher.com/rnahandlingtips)

# RNA quantitation

## Rapid, accurate RNA quality and integrity assessment

The Invitrogen™ Qubit™ RNA IQ Assay Kit and Invitrogen™ Qubit™ 4 Fluorometer work together to accurately determine if an RNA sample is degraded in just two steps. No special handling, tedious sample preparation, or waiting for results—just add as little as 1  $\mu\text{L}$  containing 0.5–1.5  $\mu\text{g}/\mu\text{L}$  of RNA and get your results typically in <4 seconds per sample. The Qubit RNA IQ Assay utilizes two unique dyes—one binds to large, intact, and/or structured RNA, and the other selectively binds to small, degraded RNA (Figure 11). Together they are able to quickly assess the quality and integrity of an RNA sample. To use, simply add your samples to the RNA IQ working solution, then measure on the Qubit 4 Fluorometer. Results are presented as a total value for the RNA sample integrity and quality or RNA IQ# and as the calculated percentage of large and small RNA in the sample (Figure 11A).

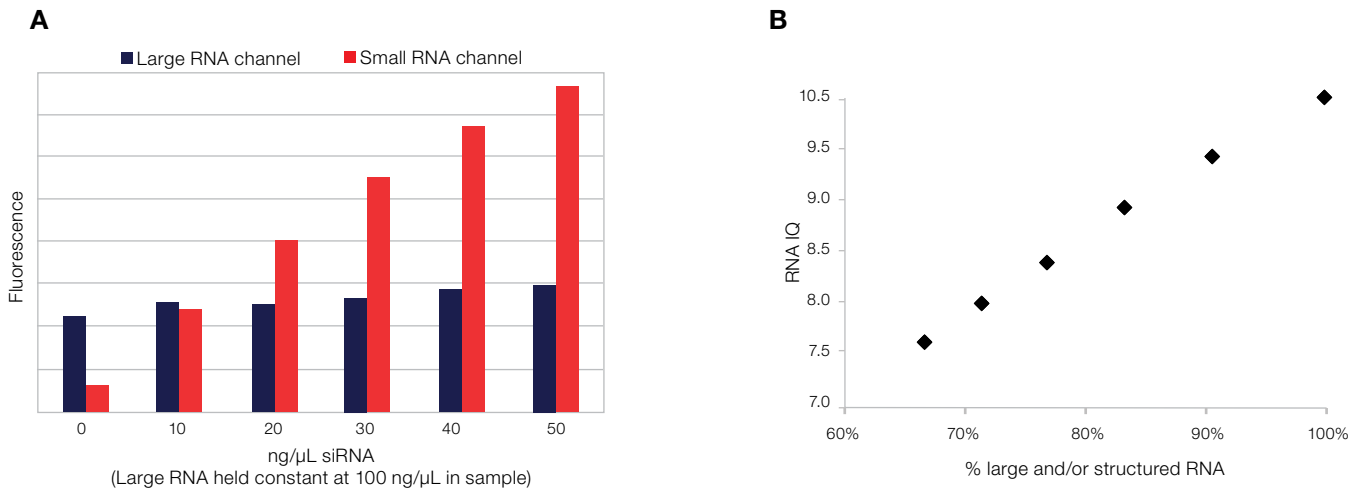


**Figure 11. Selectivity of the RNA IQ reagents for large and small RNA.** Triplicate samples containing 100 ng/mL rRNA (*E. coli*) and varying amounts of siRNA (0 to 50 ng/ $\mu\text{L}$ ) were assayed with the Qubit RNA IQ Assay Kit (Cat. Nos. Q33221, Q33222) on the Qubit 4 Fluorometer. Relative fluorescent units (RFUs) (A) and IQ#s were plotted (B) for these samples.

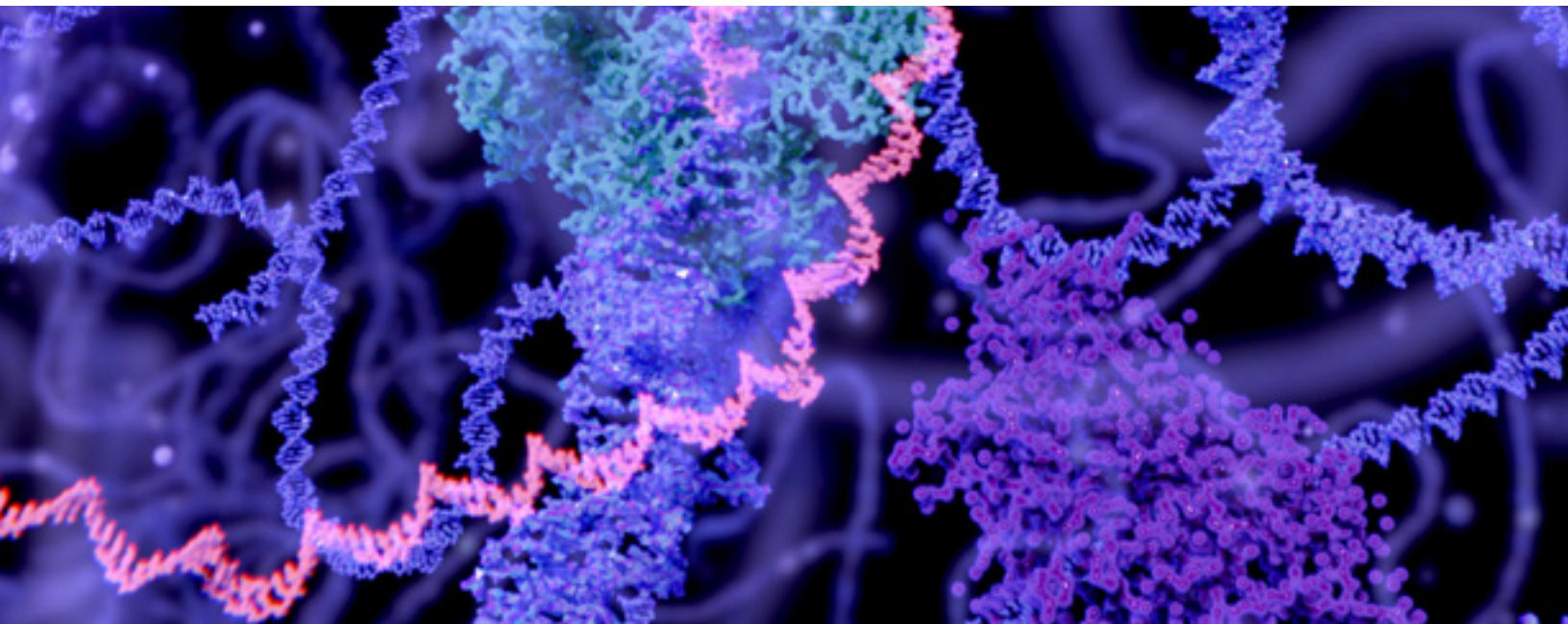
To learn more and to request a demo, go to [thermofisher.com/qubit](https://www.thermofisher.com/qubit)

The RNA IQ# is based on a scale of 1 to 10, similar to other RNA quality scores, wherein a high IQ# indicates the majority of the sample consists of large and/or structured RNA. Conversely, a small IQ# indicates the sample comprises mainly small RNA with limited tertiary structure (Figure 12).

Invitrogen™ Qubit™ RNA XR (extended-range) and HS (high-sensitivity) Assay Kits offer easy and accurate RNA quantification. The Qubit RNA XR assay is accurate for initial sample concentrations from 1 ng/μL to 10 μg/μL, and the Qubit RNA HS assay is designed for low-abundance RNA samples between 250 pg/μL and 100 ng/μL. Both assays are highly selective for RNA and do not quantitate double-stranded DNA.



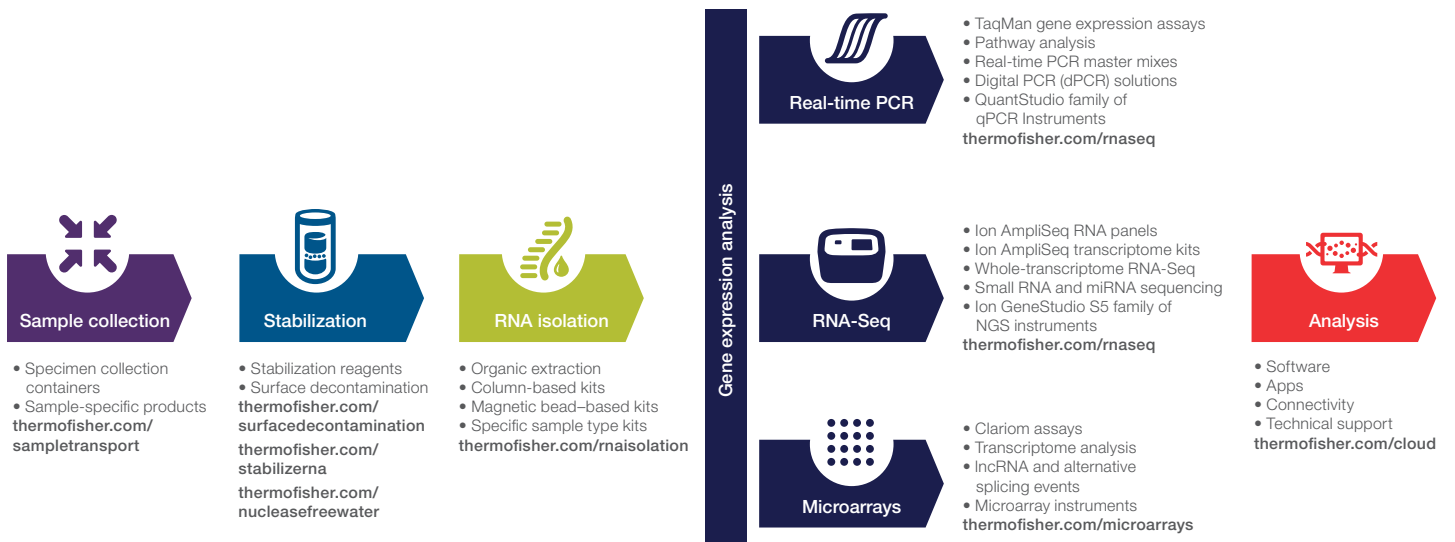
**Figure 12. Qubit RNA IQ fluorescence response and IQ# for solutions containing various amounts of large and small RNA.** Triplicate samples containing a total of 100 ng/mL RNA, comprising small RNA (Invitrogen™ *Silencer*™ Select GAPDH siRNA) and large RNA (rRNA, *E. coli*) were assayed with the Qubit RNA IQ Assay Kit (Cat. Nos. Q33221, Q33222) on the Qubit 4 Fluorometer. Relative fluorescent units (RFUs) (A) and IQ#s were plotted (B) for these samples.



# Gene expression solutions

One place for gene expression products and support

This is your one-stop shopping resource for gene expression research. We offer complete gene expression solutions including sample collection, stabilization, RNA isolation, reverse transcriptases, gene expression analysis, and quantification. In addition, we offer superior, comprehensive, end-to-end support for gene expression research. Learn how we can help you today, so you can be confident in your results.



# Gene expression research considerations

Gene transcription is an intricate and dynamic process that generates a variety of RNA types. An important consideration for the application of NGS in human disease research is whether to interrogate the whole transcriptome, targeted genes, or regulatory elements.

## Which RNA analysis solutions are right for you?

	Analysis type	Objective	Potential solutions
<b>Discovery (novel annotations and/or novel associations to annotated content)</b>	Transcriptome: exon-level discovery	Analyze complete set of RNA transcripts (coding, splice variants, and lncRNA) produced by the genome	<ul style="list-style-type: none"> <li>• Ion Total RNA-Seq v2 Kit</li> <li>• Clariom D assays—human, mouse, rat</li> </ul>
	Transcriptome: gene-level discovery (transcripts)	Analyze complete set of RNA transcripts (coding) produced by the genome	<ul style="list-style-type: none"> <li>• Clariom S assays—human, mouse, rat</li> <li>• Ion AmpliSeq transcriptome kit—human, mouse</li> <li>• Oncomine Immune Response Research Assay</li> </ul>
	Alternative splicing	Evaluate eukaryotic gene regulation at the RNA-processing level in which different mRNA molecules (isoforms/variants) are produced from the same primary transcript	<ul style="list-style-type: none"> <li>• Clariom D assay</li> <li>• Ion Total RNA-Seq v2 Kit</li> </ul>
	Long noncoding RNA (lncRNA)	Study non-protein-coding transcripts (>200 nucleotides), which are abundant in the mammalian transcriptome; these have been shown to regulate transcription, and have been implicated in a wide range of developmental processes and diseases	<ul style="list-style-type: none"> <li>• Ion Total RNA-Seq v2 Kit</li> <li>• Clariom D assays—human, mouse, rat</li> <li>• TaqMan Assays</li> </ul>
	miRNA	Profile small noncoding RNA (~22 nucleotides) generated from a hairpin structure on a precursor RNA transcribed from a particular gene, and that function in RNA silencing and posttranscriptional regulation of gene expression	<ul style="list-style-type: none"> <li>• Ion Total RNA-Seq v2 Kit</li> <li>• Applied Biosystems miRNA microarrays</li> <li>• TaqMan Advanced miRNA assays</li> </ul>
	Fusion genes and/or fusion transcripts	Interrogate hybrid genes formed from two previously separate genes that can give rise to hybrid proteins or to misregulation of transcription	<ul style="list-style-type: none"> <li>• TaqMan Assays</li> <li>• Ion AmpliSeq RNA Lung Fusion Research Panel</li> </ul>
<b>Verification</b>	All RNA types	Confirm gene expression profiles of biological samples by reliable complementary techniques	<ul style="list-style-type: none"> <li>• Ion AmpliSeq RNA panels</li> <li>• Clariom S or D assays</li> <li>• TaqMan Assays (TaqMan Array Cards, OpenArray plates)</li> <li>• QuantiGene assays</li> </ul>
<b>Profiling</b>	All RNA types	Evaluate the activity of many genes at once to create a global picture of expression patterns	<ul style="list-style-type: none"> <li>• Ion AmpliSeq RNA panels</li> <li>• Clariom S or D assays</li> <li>• TaqMan Assays</li> <li>• QuantiGene assays</li> </ul>
	miRNA	Profile small noncoding RNA (~22 nucleotides) generated from a hairpin structure on a precursor RNA transcribed from a particular gene, and that function in RNA silencing and posttranscriptional regulation of gene expression	<ul style="list-style-type: none"> <li>• TaqMan Advanced miRNA assays (plates and cards)</li> <li>• Applied Biosystems miRNA microarrays</li> </ul>

Find out more at [thermofisher.com/idealmatch](https://www.thermofisher.com/idealmatch)

# Superior cDNA synthesis for any application

## SuperScript IV Reverse Transcriptase

With over 50,000 citations, reviews, and publications, Invitrogen™ SuperScript™ reverse transcriptases are among the most trusted and widely used products for cDNA synthesis. Invitrogen™ SuperScript™ IV Reverse Transcriptase is the latest enzyme in the portfolio, engineered to deliver superior cDNA synthesis performance with even the most challenging RNA samples.

- **Super-efficient**—up to 100x higher cDNA yields than with other reverse transcriptase enzymes
- **Super-sensitive**—transcribes even from degraded or inhibitor-containing RNA, with low input amounts
- **Super-robust**—high thermostability and processivity for superior cDNA synthesis
- **Super-fast**—10 min cDNA synthesis protocol

### Reverse transcription reagent selection guide

We offer a comprehensive portfolio of enzymes and kits within the SuperScript IV family to suit your research needs. Start with the selection guide below to find the best format for common cDNA synthesis applications.



Find out more at [thermofisher.com/ssiv](https://www.thermofisher.com/ssiv)

Product format	Stand-alone enzyme	First-strand cDNA synthesis kit	One-step RT-PCR kit
Recommended product	SuperScript IV Reverse Transcriptase	SuperScript IV First-Strand Synthesis System	SuperScript IV One-Step RT-PCR System
Applications	RT-PCR, qRT-PCR, sequence detection, gene expression analysis, transcript variant detection, cloning, cDNA library construction, RACE, RNA-Seq	RT-PCR, qRT-PCR, sequence detection, gene expression analysis, transcript variant detection, cloning, cDNA library construction, RACE, RNA-Seq	RT-PCR, sequence detection, cloning, genotyping, high-throughput analysis
Input total RNA	1 pg–5 µg	1 pg–5 µg	0.01 pg–1 µg
Optimal reaction temperature	50–55°C	50–55°C	50–55°C
Reaction time	10 min	10 min	10 min
cDNA synthesis with challenging or degraded RNA	Yes	Yes	Yes



# Complete kit with flexible priming options

## SuperScript IV First-Strand Synthesis System



The Invitrogen™ SuperScript™ IV First-Strand Synthesis System is optimized for synthesis of first-strand cDNA from purified poly(A)+ or total RNA. The kit contains all components needed for reverse transcription, plus an additional control gene and primers, providing the flexibility to customize the reaction setup to fit the needs of your application.

Find out more at [thermofisher.com/ssiv-firststrand](https://thermofisher.com/ssiv-firststrand)

# Enabling faster, more efficient RT-PCR

## SuperScript IV One-Step RT-PCR System



Even with challenging RNA samples, you can get more efficient results faster and easier than with any other RT-PCR reagent. The Invitrogen™ SuperScript™ IV One-Step RT-PCR System combines high-processivity SuperScript IV Reverse Transcriptase and high-fidelity Invitrogen™ Platinum™ SuperFi™ DNA Polymerase to provide superior one-step RT-PCR performance.

- **Two-phase hot-start activation mechanism**—for high specificity, improved yields, and easy room-temperature setup
- **Superior sensitivity and speed**—down to 0.01 pg of RNA, target length up to 13.8 kb, and the fastest one-step RT-PCR protocol
- **Reliable target detection**—even in RNA samples with suboptimal purity
- **Fast and easy gDNA removal**—for superior accuracy and confidence in your results

Find out more at [thermofisher.com/ssiv-onestep](https://thermofisher.com/ssiv-onestep)

### Doing qRT-PCR?

Invitrogen™ SuperScript™ IV VILO™ Master Mix offers exceptional cDNA synthesis for qRT-PCR applications, while maintaining superior linearity across the broadest range of input RNA. Learn more at [thermofisher.com/4vilo](https://thermofisher.com/4vilo)



# Which instrument fits your needs?

## QuantStudio real-time PCR and digital PCR systems

Flexibility. Versatility. Connectivity. Speed. Precision. Everyone's needs are unique and that's why we have expanded the Applied Biosystems™ QuantStudio™ family


of real-time PCR and digital PCR systems. Now you can pick the qPCR platform that best fits your research requirements—find your fit today.

For when you need:	Ultimate simplicity	Total control	Room to grow	More versatility	Maximum productivity
	QuantStudio™ 3 system	QuantStudio™ 5 system	QuantStudio™ 6 Flex system	QuantStudio™ 7 Flex system	QuantStudio™ 12K Flex system
	Real-time PCR				Digital PCR



<b>Colors</b>	4 colors	5 or 6 colors (21 filter combinations)	5 colors	6 colors (21 filter combinations)	6 colors (21 filter combinations)
<b>Available formats*</b>	<ul style="list-style-type: none"> <li>96-well (0.2 mL block)</li> <li>96-well Fast (0.1 mL block)</li> </ul>	<ul style="list-style-type: none"> <li>96-well (0.2 mL block)</li> <li>96-well Fast (0.1 mL block)</li> <li>384-well</li> </ul>	<ul style="list-style-type: none"> <li>96-well</li> <li>96-well Fast</li> <li>384-well</li> </ul>	<ul style="list-style-type: none"> <li>96-well</li> <li>96-well Fast</li> <li>384-well</li> <li>TaqMan Array card (384-well microfluidic card)</li> </ul>	<ul style="list-style-type: none"> <li>96-well</li> <li>96-well Fast</li> <li>384-well</li> <li>TaqMan Array card (384-well microfluidic card)</li> <li>OpenArray plates (3,072 through-holes)</li> </ul>
<b>Dimensions</b>	27 x 50 x 40 cm	27 x 50 x 40 cm	90.7 x 74.7 x 12.5 cm	90.7 x 74.7 x 12.5 cm	90.7 x 74.7 x 12.5 cm
<b>Block change</b>	Fixed	Fixed	Block change from front in less than 1 min; no tools required		
<b>VeriFlex Blocks temperature control</b>	3 zones	6 zones (96-well blocks only)	N/A	N/A	N/A
<b>Automation-compatible</b>	No	No	No	Yes	Yes
<b>Throughput</b>	Medium	Medium	Medium	High	Very high
<b>21 CFR Part 11–enablement</b>	Security	Security, auditing, e-signature package	Optional security, auditing, e-signature packages available		
<b>Touchscreen</b>	Yes, interactive	Yes, interactive	Yes	Yes	Yes
<b>Key applications</b>	<ul style="list-style-type: none"> <li>Gene expression</li> <li>miRNA profiling</li> <li>SNP genotyping</li> <li>Copy number variation</li> <li>Protein thermal shift</li> <li>High resolution melt</li> <li>Pathogen detection</li> </ul>	<ul style="list-style-type: none"> <li>Gene expression</li> <li>miRNA profiling</li> <li>SNP genotyping</li> <li>Copy number variation</li> <li>Protein thermal shift</li> <li>High resolution melt</li> <li>Pathogen detection</li> </ul>	<ul style="list-style-type: none"> <li>Gene expression</li> <li>miRNA profiling</li> <li>SNP genotyping</li> <li>Copy number variation</li> <li>Protein thermal shift</li> <li>High resolution melt</li> <li>Pathogen detection</li> </ul>	<ul style="list-style-type: none"> <li>Gene expression</li> <li>miRNA profiling</li> <li>SNP genotyping</li> <li>Copy number variation</li> <li>Protein thermal shift</li> <li>High resolution melt</li> <li>Pathogen detection</li> <li>Pharmacogenomics</li> </ul>	<ul style="list-style-type: none"> <li>Gene expression</li> <li>miRNA profiling</li> <li>SNP genotyping</li> <li>Copy number variation</li> <li>Protein thermal shift</li> <li>High resolution melt</li> <li>Pathogen detection</li> <li>Pharmacogenomics</li> <li>Growing menu of qualified solutions</li> </ul>

\* Some instruments are also available in a diagnostic format. Learn more at [thermofisher.com/qsdX](http://thermofisher.com/qsdX).

 = cloud-enabled instrument

# Which thermal cycler or PCR instrument fits your needs?

## Applied Biosystems thermal cyclers

Once RNA is purified and ready for cDNA synthesis or library preparation, it is important to use high-quality thermal cyclers to ensure efficient cDNA synthesis or adapter ligation. Our engineers have been designing and manufacturing high-quality thermal cyclers since 1987.


In that time, Applied Biosystems™ thermal cyclers have built a reputation for reliability, accuracy, and user-friendly interfaces. Our instruments enable precise, consistent results for every challenge, application, and budget.

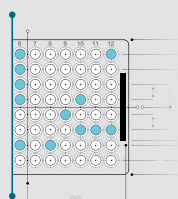
Key features:	Ultimate flexibility and throughput	Elegantly simple and precise	Proven reliability, precise PCR optimization	Routine PCR, elevated	Routine PCR	Designed for easy robotic integration
	ProFlex™ PCR system	SimpliAmp™ Thermal Cycler	Veriti™ Thermal Cycler*	MiniAmp™ Plus Thermal Cycler	MiniAmp™ Thermal Cycler	Automated Thermal Cycler



Max. sample throughput	480,000 reactions	96 reactions	384 reactions	96 reactions	96 reactions	384 reactions
Max. block ramp rate	6.0°C/sec	4.0°C/sec	5.0°C/sec	3.5°C/sec	3.0°C/sec	3.5°C/sec
Block formats (temperature optimization)	<ul style="list-style-type: none"> <li>3 x 32-well 0.2 mL (2-zone VeriFlex Block)</li> <li>96-well 0.2 mL (6-zone VeriFlex Block)</li> <li>2 x 96-well 0.2 mL</li> <li>2 x flat block</li> <li>2 x 384-well 0.02 mL</li> </ul>	<ul style="list-style-type: none"> <li>96-well 0.2 mL (3-zone VeriFlex Block)</li> </ul>	<ul style="list-style-type: none"> <li>96-well 0.2 mL (6-zone VeriFlex Block)</li> <li>Fast 96-well 0.1 mL</li> <li>384-well 0.02 mL</li> <li>60-well 0.5 mL</li> </ul>	<ul style="list-style-type: none"> <li>96-well 0.2 mL (3-zone VeriFlex Block)</li> </ul>	<ul style="list-style-type: none"> <li>96-well 0.2 mL</li> </ul>	<ul style="list-style-type: none"> <li>96-well 0.2 mL compatible with full- or semi-skirted plates</li> <li>384-well 0.02 mL</li> </ul>

\* Also available as an FDA Class 1/CE-IVD labeled device.

 = cloud-enabled instrument



**Don't forget reagents**—choose from the PCR enzymes you know and trust, such as SuperScript reverse transcriptases and Platinum SuperFi reagents.

# RNA technical resources

## Collection, protection, isolation, and gene expression

Consider us to be your essential resource for all your nucleic acid purification and analysis support needs. Navigate through the DNA and RNA support categories below to obtain relevant technical information, view tips and tricks when starting an experiment, and find answers to everyday problems.



### Support

- [thermofisher.com/napsupport](https://thermofisher.com/napsupport)
- [thermofisher.com/technicalresources](https://thermofisher.com/technicalresources)
- Email us at [techsupport@thermofisher.com](mailto:techsupport@thermofisher.com)



### Web resources

- [thermofisher.com/contactus](https://thermofisher.com/contactus)
- [thermofisher.com/prepforsuccess](https://thermofisher.com/prepforsuccess)
- [thermofisher.com/gdnaprep](https://thermofisher.com/gdnaprep)
- [thermofisher.com/plasmidprep](https://thermofisher.com/plasmidprep)
- [thermofisher.com/endofreeplasmid](https://thermofisher.com/endofreeplasmid)
- [thermofisher.com/lowendoplasmid](https://thermofisher.com/lowendoplasmid)

To learn more and order, go to [thermofisher.com/rnabasics](https://thermofisher.com/rnabasics)



## Services and support

Providing fast responses by experienced scientists

More than 1,300 service and support specialists worldwide partner with you to help enable your scientific success through:



**Service plans**—planned maintenance and guaranteed response times to help you avoid unnecessary downtime, reduce strain on laboratory staff, and extend the life of your instruments



**Compliance services**—timely, cost-effective, and audit-ready documentation managed by a compliance specialist to help ensure your instrument is installed, operating, and performing to the manufacturer's specifications



**Analytical validation (AV) consulting services**—technical project management, data analysis support, and documentation of your lab's AV are provided to help develop and optimize your assay validation workflow for required parameters



**Bioinformatics and IT services**—optional consulting services with a bioinformatics application scientist to review software, applications, workflow optimization, and data management



**Education services**—application and instrument training programs are available at our training centers located throughout the world, within your lab, or through web-based instruction

Find out more about our services and support at  
[thermofisher.com/instrumentservices](https://www.thermofisher.com/instrumentservices)

## Ordering information

Product	Quantity	Cat. No.
<b>Automated RNA purification</b>		
KingFisher Flex Purification System with 24 Deep-Well Head	1 system	5400640
KingFisher Flex Purification System with 96 Deep-Well Head	1 system	5400630
KingFisher Duo Prime Purification System	1 system	5400110
<b>Total RNA purification kits</b>		
TRIzol LS Reagent	100 mL	0296010
	200 mL	0296028
TRIzol Plus RNA Purification Kit	50 preps	2183555
TRIzol Reagent	100 mL	5596026
	200 mL	5596018
TRIzol Max Bacterial RNA Isolation Kit	100 preps	16096020
	200 preps	16096040
PureLink RNA Mini Kit	10 preps	2183020
	50 preps	183018A
	250 preps	2183025
PureLink RNA MicroScale kit	50 preps	12173011A
PureLink <i>Pro</i> 96 Total RNA Purification Kit	4 plates	12173011A
RecoverAll Multi-Sample RNA/DNA Isolation Workflow	120 preps	A26069
	240 preps	A26135
MagMAX-96 Total RNA Isolation Kit	96 preps	AM1830
MagMAX <i>mirVana</i> Total RNA Isolation Kit	96 preps	A27828
MagMAX FFPE DNA/RNA Ultra Kit	1 kit	A31881
MagMAX Plant RNA Isolation Kit	96 preps	A33784
MagMAX Cell-Free Total Nucleic Acid Kit	1 kit	A36716
<b>Transcriptome purification kits</b>		
RiboMinus Transcriptome Isolation Kit, yeast	6 preps	K155003
RiboMinus Transcriptome Isolation Kit, bacteria	12 preps	K155004
RiboMinus Eukaryote System v2	12 preps	A15026
RiboMinus Plant Kit for RNA-Seq	8 preps	1083808
<b>mRNA purification kits</b>		
Dynabeads mRNA Purification Kit	2 mL	61006
Dynabeads mRNA DIRECT Purification Kit	5 mL	61011
	10 mL	61012
Dynabeads mRNA DIRECT Micro Purification Kit	2 mL	61021
mRNA Catcher PLUS Purification Kit	96 preps	K1570-02
	960 preps	K1570-03

Product	Quantity	Cat. No.
<b>microRNA and small RNA purification kits</b>		
<i>mirVana</i> miRNA Isolation Kit, with phenol	40 preps	AM1560
MagMAX <i>mirVana</i> Total RNA Isolation Kit	96 preps	A27828
TaqMan MicroRNA Cells-to-C <sub>T</sub> Kit	100 preps	4391848
<b>Viral RNA purification kits</b>		
PureLink Viral RNA/DNA Mini Kit	50 preps	2280050
PureLink <i>Pro</i> 96 Viral RNA/DNA Purification Kit	4 plates	280096A
MagMAX-96 AI/ND Viral RNA Isolation Kit	384 preps	AM1835
MagMAX-96 Viral RNA Isolation Kit	96 preps	AM1836
	5 x 96 preps	AM1836-5
MagMAX Viral RNA Isolation Kit	50 preps	AM1939
<b>Cells-to-C<sub>T</sub> kits</b>		
Cells-to-C <sub>T</sub> 1-Step TaqMan Kit	20 preps	A25605
	100 preps	A25603
	400 preps	A25602
TaqMan Fast Advanced Cells-to-C <sub>T</sub> Kit	40 preps	A35374
	100 preps	A35377
	400 preps	A35378
TaqMan MicroRNA Cells-to-C <sub>T</sub> Kit	100 preps	4391848
TaqMan Fast Cells-to-C <sub>T</sub> Kit	100 preps	4399003
Cells-to-C <sub>T</sub> 1-Step <i>Power</i> SYBR Green Kit	20 preps	A25601
	100 preps	A25600
	400 preps	A25599
SYBR Green Fast Advanced Cells-to-C <sub>T</sub> Kit	40 preps	A35378
	100 preps	A35380
	400 preps	A35381
<i>Power</i> SYBR Green Cells-to-C <sub>T</sub> Kit	40 preps	4402953
Single Cell-to-C <sub>T</sub> qRT-PCR Kit	50 preps	4458237
	400 preps	4458236
Cells-to-C <sub>T</sub> Stop Solution	1 mL	4402960
Cells-to-C <sub>T</sub> Bulk Lysis Reagents	2,500 preps	491851C

Product	Quantity	Cat. No.
Stabilized Blood-to-C <sub>T</sub> Nucleic Acid Preparation Kit for qPCR, compatible with PAXgene Blood RNA Tubes	200 preps	4449082
Stabilized Blood-to-C <sub>T</sub> Nucleic Acid Preparation Kit for qPCR, compatible with Tempus Blood RNA Tubes	200 preps	4449080
Stabilized Blood-to-C <sub>T</sub> Nucleic Acid Preparation Kit for qPCR, compatible with either PAXgene or Tempus Blood RNA Tubes	50 preps	4449079
SYBR Green Cells-to-C <sub>T</sub> Control Kit	100 preps	4402959
TaqMan Cells-to-C <sub>T</sub> Control Kit	100 preps	4386995
<b>RNA lab essentials</b>		
RNase-free Tips (200 µL)	10 racks	AM12650
RNase-free Tips (1,000 µL)	10 racks	AM12660
Barrier (Filter) Tips (10 µL) (compatible with Eppendorf pipettors)	10 racks	AM12635
Barrier (Filter) Tips (20 µL)	10 racks	AM12645
Barrier (Filter) Tips (100 µL)	10 racks	AM12648
Barrier (Filter) Tips (200 µL)	10 racks	AM12655
Barrier (Filter) Tips (1,000 µL)	10 racks	AM12665
Thin-walled, frosted lid, RNase-free PCR Tubes (0.2 mL)	1,000 tubes	AM12225
PCR Tubes and Caps, RNase-free (0.2 mL, 8-strip format)	125 strips	AM12230
Thin-walled, dome cap, RNase-free PCR Tubes (0.5 mL)	1,000 tubes	AM12250
Thin-walled, frosted lid, RNase-free PCR Tubes (0.5 mL)	1,000 tubes	AM12275
RNase-free Microfuge Tubes (0.5 mL)	1,000 tubes	AM12300
Nonstick, RNase-free Microfuge Tubes (0.5 mL)	500 tubes	AM12350
RNase-free Microfuge Tubes (1.5 mL)	500 tubes	AM12400
RNase-free Microfuge Tubes (2.0 mL)	500 tubes	AM12425
Conical Tubes (15 mL) (racked)	500 tubes	AM12500
Conical Tubes (50 mL) (racked)	200 tubes	AM12501
DEPC-Treated Water	10 x 50 mL	AM9906
	1 x 100 mL	AM9915G
	5 x 100 mL	AM9916
	1 x 500 mL	AM9920
	1 x 1,000 mL	AM9922
	4 x 1,000 mL	4387937

Product	Quantity	Cat. No.
Nuclease-Free Water (not DEPC-Treated)	10 x 50 mL	AM9937
	1 x 100 mL	AM9938
	5 x 100 mL	AM9939
	1 x 500 mL	AM9930
	1 x 1,000 mL	AM9932
	4 x 1,000 mL	4387936
RT-PCR Grade Water	10 x 1.5 mL	AM9935
UltraPure DNase/RNase-Free Distilled Water	500 mL	0977015
	10 x 500 mL	0977023
	250 mL	AM9780
RNaseZap RNase Decontamination Solution	6 x 250 mL	AM9782
	4 L	AM9784
RNaseZap RNase Decontamination Wipes	100 sheets	AM9786
RNaseZap RNase Decontamination Wipes Refill	300 sheets	AM9788
ElectroZap Electrode Decontamination Solution	250 mL	AM9785
RNase AWAY Decontamination Reagent	250 mL	0328011
RNAlater Stabilization Solution	50 x 1.5 mL	AM7022
	20 x 5 mL	AM7023
	1 x 100 mL	AM7020
	1 x 250 mL	AM7024
	1 x 500 mL	AM7021
RNAlater-ICE Frozen Tissue Transition Solution	25 mL	AM7030
	10 x 25 mL	4427575
THE RNA Storage Solution	10 x 1 mL	AM7000
	50 mL	AM7001
Tempus Blood RNA Tube	50 tubes	4342792
LeukoLOCK Total RNA Isolation System	20 preps	AM1923

## Ordering information (continued)

Product	Quantity	Cat. No.
<b>RNA quantitation</b>		
Qubit 4 Fluorometer	1 fluorometer	Q33226
Qubit 4 Quantitation Starter Kit	1 kit	Q33227
Qubit 4 NGS Starter Kit	1 kit	Q33228
Qubit 4 RNA IQ Starter Kit	1 kit	Q33229
Qubit RNA IQ Assay Kit	75 assays	Q33221
	275 assays	Q33222
Qubit RNA HS Assay Kit	100 assays	Q32852
	500 assays	Q32855
Qubit microRNA Assay Kit	100 assays	Q32880
	500 assays	Q32881

Product	Quantity	Cat. No.
<b>RNA quantitation (continued)</b>		
Qubit Assay Tubes	500 tubes	Q32856
SuperScript IV VILO Master Mix	50 reactions	11756050
	500 reactions	11756500
SuperScript IV Reverse Transcriptase	2,000 units	18090010
	10,000 units	18090050
SuperScript IV First-Strand Synthesis System	4 x 10,000 units	18090200
	50 reactions	18091050
SuperScript IV One-Step RT-PCR System	200 reactions	18091200
	25 reactions	12594025
SuperScript IV One-Step RT-PCR System with ezDNase Enzyme	100 reactions	12594100
	50 reactions	12595025
	500 reactions	12595100

Find out more at [thermofisher.com/rnapreps](https://thermofisher.com/rnapreps)

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