TissueRuptor® and TissueLyser Disruption Systems

For low- to high-throughput disruption of biological samples

TissueRuptor and TissueLyser systems provide fast, effective sample disruption at a wide range of throughputs — from disruption of single samples to simultaneous disruption of up to 12, 48, or 192 samples. Human, animal, and plant tissues and other sample types can be disrupted to release high-quality DNA, RNA, and protein for subsequent purification and analysis.

Benefits of QIAGEN® sample disruption systems:

- Fast disruption of samples in minutes
- Effective, reproducible disruption and homogenization
- Compatibility with a wide range of sample types
- No cross-contamination of samples
- Fully integrated with QIAGEN automated solutions

TissueRuptor — low-throughput disruption.

TissueLyser LT — low- to medium-throughput disruption.

TissueLyser II — medium- to high-throughput disruption.

Enabling access to biological content

Genotyping, gene expression, and proteomics applications demand effective disruption of biological samples to ensure high yields of DNA, RNA, and protein. TissueRuptor and TissueLyser systems (Table 1) deliver thorough and rapid disruption of samples to fully release biomolecules, and also simultaneously homogenize samples to facilitate subsequent purification procedures using QIAGEN kits (Table 2).

Table 1. QIAGEN disruption systems for a range of throughputs

	TissueRuptor	TissueLyser LT	TissueLyser II
Throughput (samples/run)	1	Up to 12	Up to 48 or 192
Disruption technology	Rotor–stator	Bead mill	Bead mill
Disruption time	>30 seconds	40 seconds to 5 minutes	20 seconds to 5 minutes

Automated solutions from sample to result

TissueRuptor and TissueLyser systems are integral parts of QIAGEN's complete solution for sample management — from sample collection to purification and analysis of DNA, RNA, and protein. Optimized protocols integrate sample disruption with biomolecule purification, enabling a streamlined, efficient workflow. In addition, a range of automated solutions allow purification and analysis of biomolecules at low to high throughputs (Tables 3–4).

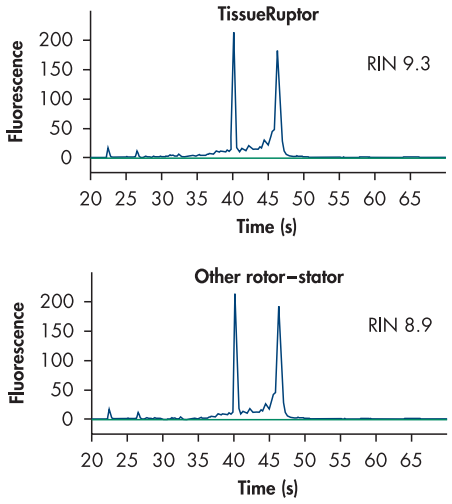

Figure 1. Pure RNA with high RIN values. Frozen liver samples (30 mg each) were disrupted at full speed for 30 seconds using either the TissueRuptor with disposable probes or a traditional rotor–stator homogenizer with a steel generator probe. Total RNA was purified using the RNeasy® Plus Mini Kit and analyzed on the Agilent® 2100 bioanalyzer. The high RNA Integrity Number (RIN) indicates the high quality of the RNA.

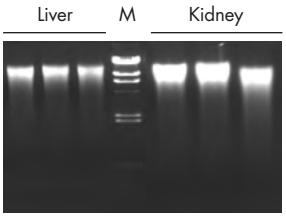

Figure 2. Reproducible purification of high-quality genomic DNA. Frozen liver and kidney samples (30 mg each) were disrupted in lysis buffer at full speed for 30 seconds using the TissueRuptor. Genomic DNA was purified using the AllPrep® DNA/RNA Mini Kit and analyzed by agarose gel electrophoresis. **M**: markers

TissueRuptor

The TissueRuptor is a handheld rotor–stator homogenizer that provides rapid and effective disruption of individual samples. Disruption at full speed for as little as 30 seconds is usually sufficient to release nucleic acids or proteins from starting material.

Benefits of the TissueRuptor:

- Rapid, effective disruption of a range of sample types
- Disposable probes help to eliminate cross-contamination
- Time savings through use of disposable probes
- Visual monitoring of disruption using transparent probes
- Seamless integration with QIAGEN sample technologies

Rapid, effective disruption

The TissueRuptor is a portable device to which a TissueRuptor Disposable Probe is attached. The blade of the probe rotates at a very high speed, causing simultaneous disruption and homogenization of a sample through a combination of turbulence and mechanical shearing. Samples that can be processed include human, animal, and plant tissues.*

For most tissues, disruption and homogenization using the TissueRuptor gives comparable results to traditional rotor–stator homogenization (Figure 1). Effective disruption of tissue samples using the TissueRuptor allows reproducible purification of high-quality DNA and RNA using QIAGEN nucleic acid purification kits (Figures 1–3). Intact proteins can also be successfully purified from tissues disrupted using the TissueRuptor (Figure 4).

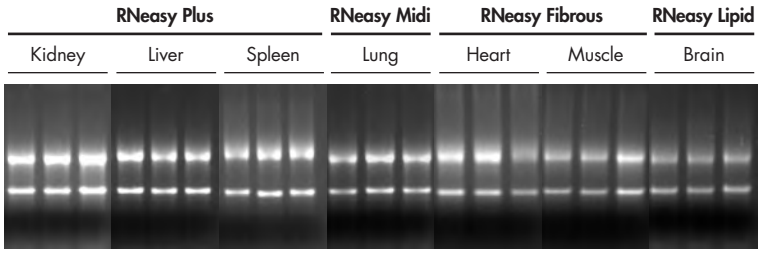

Figure 3. Efficient disruption and homogenization of animal tissues. The following tissues were disrupted at full speed for 30 seconds using the TissueRuptor: frozen kidney, liver, and spleen (10 mg each); frozen lung (250 mg); stabilized heart, muscle, and brain (10 mg each). Samples were either disrupted in lysis buffer (kidney, liver, spleen, lung, heart, and muscle) or QIAzol® Lysis Reagent (brain). Total RNA was purified using the RNeasy Plus Mini Kit (**RNeasy Plus**), the RNeasy Midi Kit (**RNeasy Midi**), the RNeasy Fibrous Tissue Mini Kit (**RNeasy Fibrous**), or the RNeasy Lipid Tissue Mini Kit (**RNeasy Lipid**). Purified RNA was analyzed by formaldehyde agarose gel electrophoresis. The gels show the high yields and quality of the RNA following disruption using the TissueRuptor.

* For plant tissues that are more difficult to disrupt, the TissueLyser II is recommended.

Time savings and no cross-contamination

After disruption of a sample, the TissueRuptor Disposable Probe can be discarded, and a new probe can be used to disrupt the next sample. Time is saved and cross-contamination is avoided, as there is no need to clean and reuse the same probe. In addition, the TissueRuptor Disposable Probe is transparent, which allows visual monitoring of the sample disruption process.

Integration with QIAGEN sample technologies

QIAGEN has tested use of the TissueRuptor in combination with proven QIAGEN sample preparation kits (Table 2). Sample disruption with the TissueRuptor ensures maximal yields of nucleic acids and proteins that perform well in downstream applications such as PCR, western blotting, and enzyme assays (Figures 4 and 5).

QIAGEN also provides RNA*later*® RNA Stabilization Reagent (to stabilize RNA) and Allprotect Tissue Reagent (to stabilize DNA, RNA, and protein). Tissues collected in these reagents can also be easily disrupted with the TissueRuptor.

Table 2. QIAGEN purification kits compatible with QIAGEN disruption systems

Analyte purified	Sample type	QIAGEN kit
RNA	Easy-to-lyse tissue	RNeasy Kits
		RNeasy Plus Kits
		RNeasy Protect Kits
RNA	Fiber-rich tissue	RNeasy Fibrous Tissue Kits
RNA	All types of tissue	RNeasy Lipid Tissue Kits
		RNeasy Universal Tissue Kits
RNA	Plant tissue	RNeasy Plant Mini Kit
RNA	Yeast	RNeasy Kits
RNA	Bacteria	RNeasy Protect Bacteria Kits
microRNA	All types of tissue	miRNeasy Kits
DNA	Human tissue	QIAamp DNA Kits
DNA	Animal tissue	DNeasy® Blood & Tissue Kits
DNA	Plant tissue	DNeasy Plant Kits
Protein	Tissue	Qproteome® Mammalian Protein Prep Kit
Phosphoprotein	Tissue	PhosphoProtein Purification Kit
Glycoprotein	Tissue	Qproteome Glycoprotein Kits
DNA and RNA	Tissue	AllPrep DNA/RNA Kits
DNA, RNA, and protein	Tissue	AllPrep DNA/RNA/Protein Mini Kit

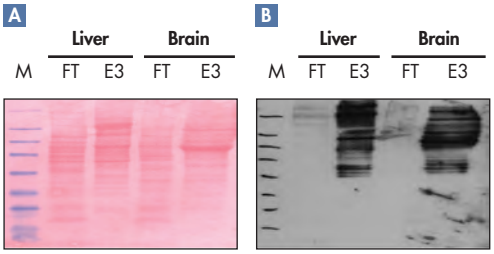

Figure 4. Successful purification of phosphoproteins from rat liver and brain. Frozen rat liver and brain (approximately 30 mg each) were disrupted at medium speed for 30–60 seconds in 350 µl PhosphoProtein Lysis Buffer. The homogenized samples were then diluted with 1500 µl PhosphoProtein Lysis Buffer and incubated at 4°C for 30 minutes, with brief vortexing every 10 minutes. Phosphoproteins were purified using the PhosphoProtein Purification Kit and detected by western blotting. A Transfer membrane stained with Ponceau S, and B western blot. **M**: markers; **FT**: flow-through; **E3**: elution fraction 3.

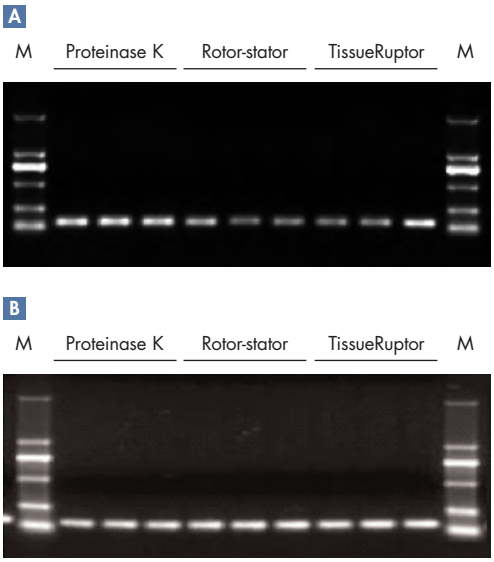

Figure 5. High performance results in PCR. A Liver and B heart samples (25 mg each, frozen) were disrupted with the TissueRuptor or a traditional rotor–stator homogenizer and lysed for 1 hour with proteinase K, or lysed overnight with proteinase K without sample disruption. DNA was purified using the QIAamp® DNA Mini Kit. Eluates (5 µl) were subjected to PCR using HotStarTaq® DNA Polymerase and primers specific for the 18S ribosomal RNA gene. **M**: GelPilot® Mid Range Ladder (QIAGEN, cat. no. 239135).

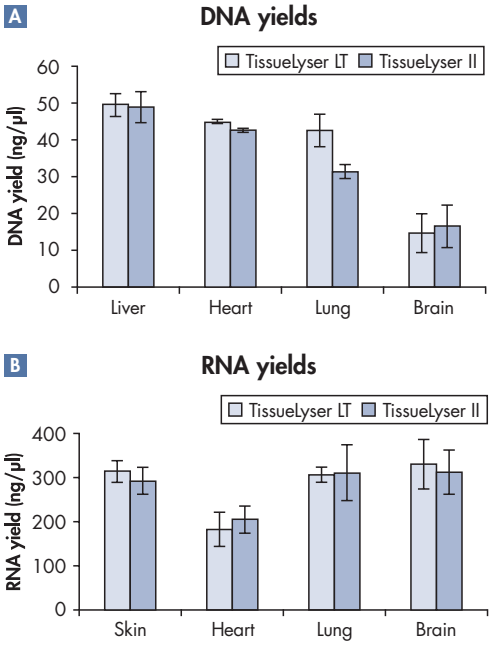

Figure 6. Effective tissue disruption. Various rat tissues were disrupted using the TissueLyser LT or TissueLyser II. A DNA was purified from 25 mg samples on the QIAcube using the DNeasy Blood & Tissue Kit. DNA yields were determined using a spectrophotometer. B RNA was purified from 20 mg samples on the QIAcube using the RNeasy Fibrous Tissue Mini Kit (skin, heart, and lung) or RNeasy Lipid Tissue Mini Kit (brain). RNA yields were determined using a spectrophotometer.

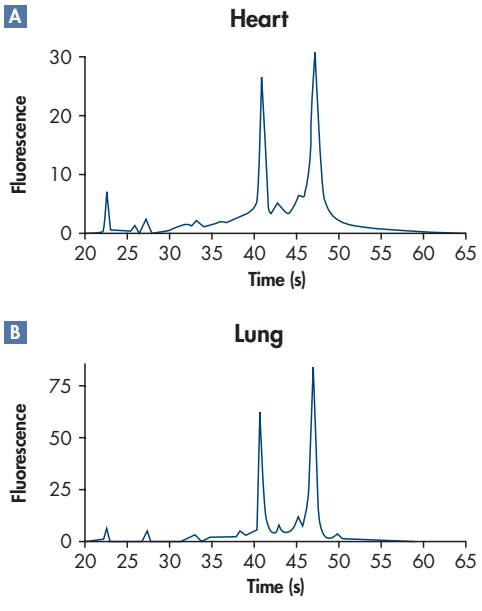

Figure 7. Pure RNA with high RIN values. Rat heart and lung (20 mg each) were disrupted using the TissueLyser LT. RNA was purified on the QIAcube using the RNeasy Fibrous Tissue Mini Kit and then analyzed on the Agilent 2100 bioanalyzer. The RIN values were 8.3 (heart) and 9 (lung).

TissueLyser LT

The TissueLyser LT is a small bead mill which provides fast, effective disruption of up to 12 samples at the same time. This throughput matches that of the QIAcube®, which automates sample preparation using trusted QIAGEN spin-column kits.

Benefits of the TissueLyser LT:

- Simultaneous disruption of up to 12 samples
- Compact instrument with small footprint
- Coolable adapter to prevent biomolecule degradation
- Reproducible results with all sample types
- Compatible with all laboratory workflows

Disruption of up to 12 samples

The TissueLyser LT works in combination with the TissueLyser LT Adapter. Up to twelve 2 ml tubes, each containing a sample and a bead, are loaded into the adapter, which is securely fastened to the piston of the TissueLyser LT. The piston moves up and down rapidly, leading to simultaneous disruption and homogenization of the samples due to the beating and grinding action of the beads. Disruption with the TissueLyser LT is comparable to that achieved with the well-established TissueLyser II (Figures 6 and 8–10).

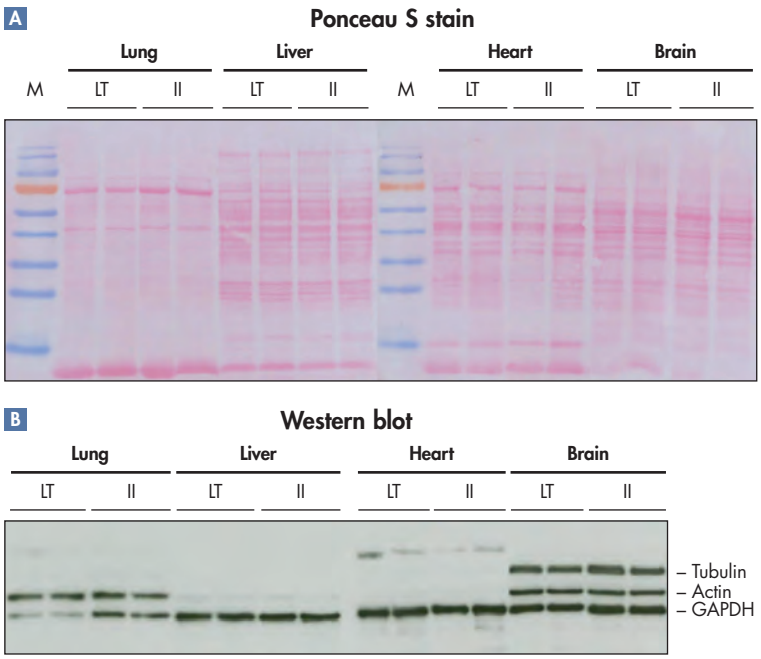

Figure 8. Intact protein suitable for all types of analysis. Various rat tissues (25 mg each) stabilized in Allprotect Tissue Reagent were disrupted using the TissueLyser LT or TissueLyser II. Total protein was purified using the Qproteome Mammalian Protein Prep Kit and then analyzed by western blotting. A Transfer membrane stained with Ponceau S, and B western blot. **LT**: TissueLyser LT; **II**: TissueLyser II; **M**: markers.

Compact instrument with coolable adapter

The TissueLyser LT has a small footprint of 15 cm x 27 cm, allowing installation in any laboratory. As each sample is safely sealed within its own tube, the TissueLyser LT is able to disrupt multiple samples without any risk of cross-contamination. If disrupting fresh or frozen samples, the TissueLyser LT Adapter can be precooled on dry ice to prevent degradation of nucleic acids and proteins (Figures 10–11). Tissues stored in Allprotect Tissue Reagent (to stabilize DNA, RNA, and protein) or in RNA*later* RNA Stabilization Reagent (to stabilize RNA) require no precooling of the adapter.

Reproducible results

The TissueLyser LT provides effective disruption of human, animal, and plant tissues, bacteria, and yeast, allowing reproducible yields of DNA, RNA, and protein in subsequent purification procedures (Figure 6). Even difficult-to-lyse tissues such as heart and brain can be processed by the TissueLyser LT. DNA, RNA, and protein remain intact after disruption (Figures 7–11), enabling reliable analysis in downstream applications.

Compatible with all workflows

The TissueLyser LT is fully compatible with QIAGEN manual sample preparation kits (Table 2), and also complements QIAGEN's range of automated solutions for medium-throughput sample preparation and analysis (Table 3). These include the QIAcube, which automates sample purification using QIAGEN spin-column kits, and the QIAxcel®, which automates multicapillary gel electrophoresis of DNA and RNA. Find out more at www.qiagen.com/automation.

Table 3. QIAGEN medium-throughput automation

Instrument	Purpose	Throughput
QIAcube	Purification of DNA, RNA, and protein	Up to 12 samples per run
EZ1® Advanced	Purification of DNA and RNA from human samples	Up to 6 samples per run
EZ1 Advanced XL	Purification of DNA and RNA from human samples	Up to 14 samples per run
QIAxcel	Electophoretic analysis of DNA fragments and RNA	Up to 96 samples per run
QIAgility™	Reaction setup	Up to 96 samples per run
Rotor-Gene® Q	Real-time PCR and high-resolution melting (HRM) analyses	Up to 100 samples per run
PyroMark Q24	Methylation and mutation analyses	Up to 24 samples per run

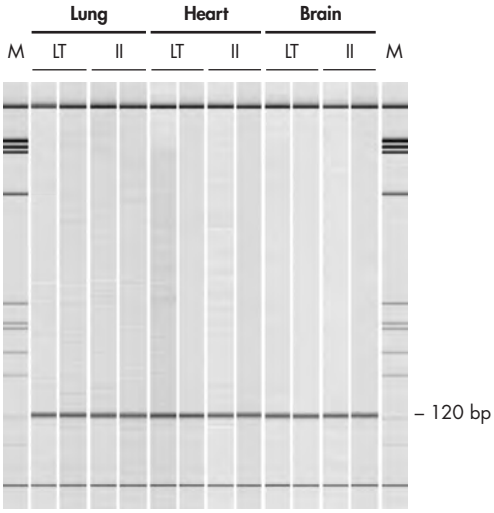

Figure 9. High-quality DNA from animal tissues. Various rat tissues (25 mg each) stabilized in Allprotect Tissue Reagent were disrupted using the TissueLyser LT or TissueLyser II. DNA was purified on the QIAcube using the DNeasy Blood & Tissue Kit, and then used in PCR with the HotStarTaq *Plus* Master Mix Kit and a PGK1 primer system. The 120 bp PCR product was analyzed on the QIAxcel using the QIAxcel DNA High Resolution Kit. **LT**: TissueLyser LT; **II**: TissueLyser II; **M**: markers.

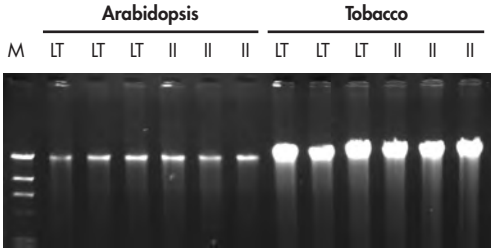

Figure 10. High-quality DNA from plant tissues. Various plant tissues (100 mg each) were disrupted in precooled adapters using the TissueLyser LT or TissueLyser II. DNA was purified on on the QIAcube using the DNeasy Plant Mini Kit and then analyzed on an agarose gel. **LT**: TissueLyser LT; **II**: TissueLyser II; **M**: markers.

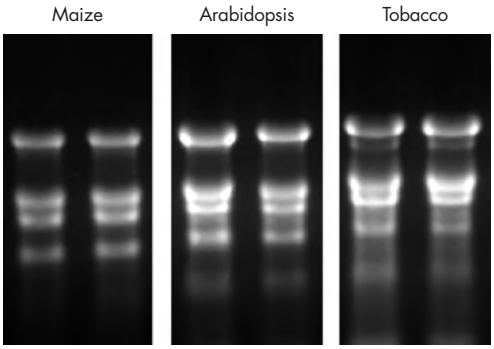

Figure 11. Intact RNA from plant tissues. Various plant tissues (100 mg each) were disrupted in duplicate in precooled adapters using the TissueLyser LT. RNA was purified using the RNeasy Plant Mini Kit and then analyzed on an agarose gel. The sharp ribosomal RNA bands indicate purification of intact RNA.

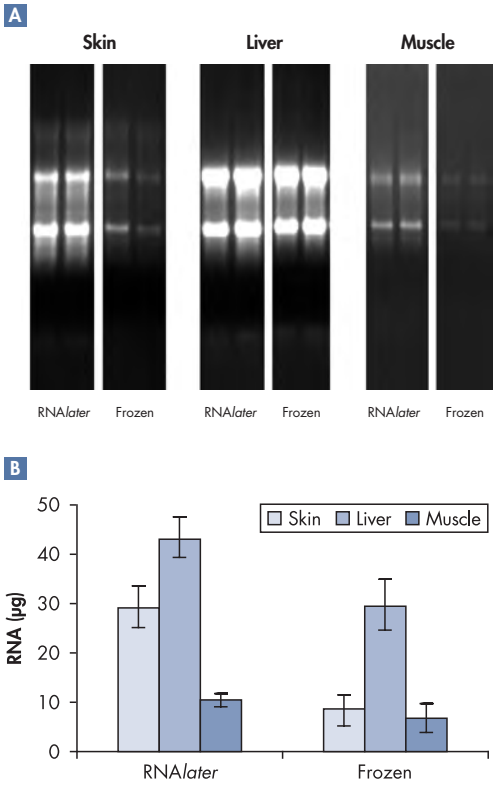

Figure 12. Efficient disruption and homogenization of animal tissues. Tissues (20 mg) were either frozen (**Frozen**) or stabilized in RNA*later* RNA Stabilization Reagent (**RNA*later***), and then disrupted using the TissueLyser II (2 x 2 minutes for liver and muscle; 2 x 5 minutes for skin). RNA was purified using the RNeasy Mini Kit (liver), RNeasy Fibrous Tissue Mini Kit (skin), or RNeasy Lipid Tissue Mini Kit (muscle). **A** Analysis on a 1.2 % formaldehyde agarose gel shows sharp ribosomal RNA bands, indicating intact RNA. **B** RNA yields were quantified by A_{260} nm absorbance measurements.

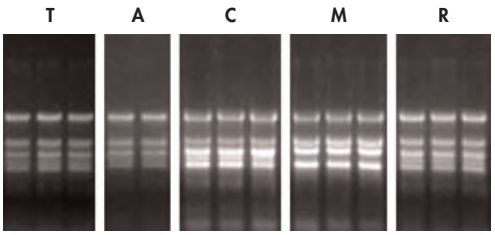

Figure 13. Reproducible purification of intact RNA from plant tissues. Frozen plant leaves were disrupted using the TissueLyser II (2 x 1 minute). RNA was purified using the RNeasy Plant Mini Kit and analyzed on a 1.2 % formaldehyde agarose gel. The ribosomal RNA bands were sharp and of equal intensity, indicating reproducible purification of intact RNA. **T**: Tomato (100 mg); **A**: Arabidopsis (25 mg); **C**: Cotton (100 mg); **M**: Maize (100 mg); **R**: Rape (100 mg).

TissueLyser II

The TissueLyser II is a well-established bead mill that rapidly and effectively disrupts up to 48 or 192 samples at the same time. The instrument enables fast access to DNA, RNA, and protein in multiple biological samples, providing the optimal starting point for high-throughput applications in fields such as systems biology.*

Benefits of the TissueLyser II:

- Convenient and secure disruption process
- Adapter sets optimized for high-throughput disruption
- Wide range of accessories available
- Reproducible results with difficult-to-lyse tissues
- Front-end solution for QIAGEN automation

Convenient, secure disruption

Each sample is placed with a bead into a tube and shaken at high speed. The beads beat and grind the samples, causing simultaneous disruption and homogenization. As each tube is securely sealed, there is no risk of cross-contamination. Tubes are loaded into either the TissueLyser Adapter Set 2 x 24 (holds up to 48 tubes) or the TissueLyser Adapter Set 2 x 96 (holds up to 192 tubes). The adapters can be precooled at –80°C if disrupting samples without lysis buffer.

Reproducible results

The TissueLyser II is well-suited for high-throughput disruption of human, animal, and plant tissues, bacteria, and yeast. Highly reproducible purification of high-quality DNA, RNA, miRNA, and protein is achieved, even with difficult-to-lyse tissues (Figures 12–17).

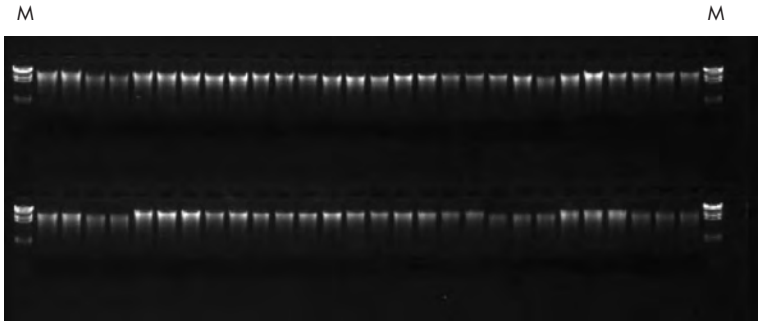

Figure 14. Reproducible DNA purification from animal tissue. From a single rat, the heart was excised and cut into 96 x 25 mg pieces, which were then disrupted using the TissueLyser II (2 x 15 seconds). Automated DNA purification was carried out on the QIAcube using the DNeasy Blood & Tissue Kit (with Reagent DX to minimize lysate foaming). Analysis of 48 samples on an agarose gel showed consistent amounts of DNA from each sample. **M**: markers.

* Visit www.qiagen.com/NGS to find out how the TissueLyser II is used in Next Generation Sequencing.

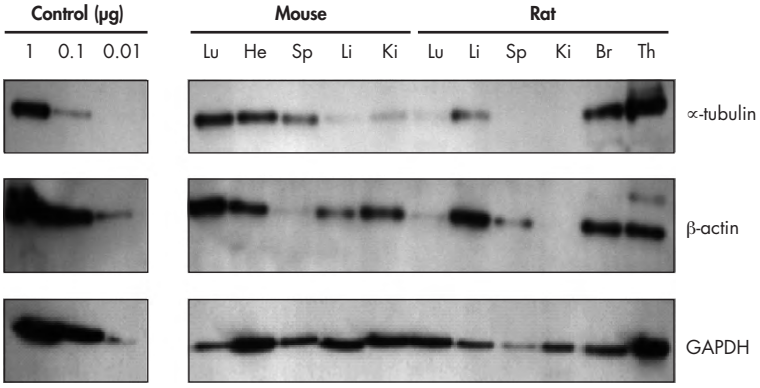

Figure 15. Purification of intact protein from various animal tissues. Tissue samples (50 mg) were placed in Mammalian Cell Lysis Buffer precooled to 4°C, and disrupted for 3 x 90 seconds at 20 Hz using the TissueLyser II. Lysates (15 µg) were analyzed by western blotting using antibodies against ∝-tubulin, β-actin, and GAPDH. As a positive control, purified proteins (1 µg, 100 ng, and 10 ng) were also analyzed. **Lu**: lung; **He**: heart; **Sp**: spleen; **Li**; liver; **Ki**: kidney; **Br**: brain; **Th**: thymus.

For RNA applications, stabilization of fresh tissues in RNA*later* RNA Stabilization Reagent prevents RNA degradation during sample handling. For applications requiring purification of DNA, RNA, and protein, these 3 analytes can be immediately stabilized by placing fresh tissues in Allprotect Tissue Reagent.*

Front-end solution for QIAGEN automation

The TissueLyser II complements QIAGEN automation for high-throughput sample preparation and analysis (Table 4), such as the QIAsymphony® SP. This easy-to-use instrument automates purification of DNA, RNA, and protein from 1–96 samples. Find out more about QIAGEN automation at www.qiagen.com/automation. The TissueLyser II is also compatible with QIAGEN manual sample preparation kits (Table 2).

Table 4. QIAGEN high-throughput automation

Instrument	Purpose	Throughput
QIAsymphony SP	Purification of DNA, RNA, and protein	1–96 samples per run
BioRobot® Universal System	Purification of DNA and RNA	96-well format
QIAxcel	Electophoretic analysis of DNA fragments and RNA	Up to 96 samples per run
QIAgility	Reaction setup	Up to 96 samples per run
Rotor-Gene Q	Real-time PCR and high-resolution melting (HRM) analyses	Up to 100 samples per run
PyroMark Q96 MD or ID	Methylation and mutation analyses	Up to 96 samples per run

* RNA*later* RNA Stabilization Reagent (cat. nos. 76104 and 76106 for 50 ml and 250 ml, respectively) and Allprotect Tissue Reagent (cat. no. 76405) are available from QIAGEN. RNA*later* TissueProtect Tubes (resealable tubes prealiquoted with RNA*later* Reagent) are also available; please inquire.

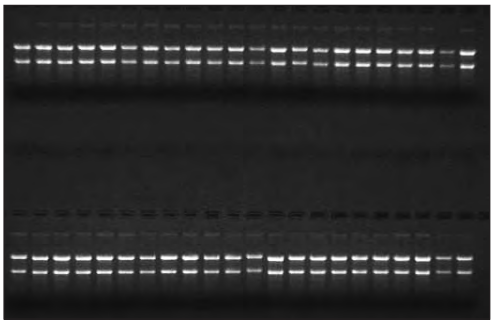

Figure 16. Reproducible purification of intact RNA from Gram-positive bacteria. A *B. subtilis* culture was stabilized using RNAprotect® Bacteria Reagent. Individual samples (2.5 x 10^8 cells each) were disrupted in lysis buffer for 5 minutes at 30 Hz using the TissueLyser II. Total RNA was purified using the RNeasy Protect Bacteria Mini Kit and analyzed on a formaldehyde agarose gel.

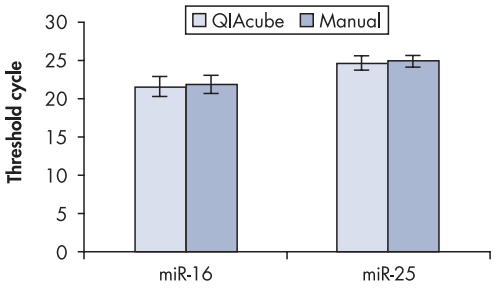

Figure 17. Reliable detection of miRNAs. Rat kidney was stabilized in RNA*later* RNA Stabilization Reagent, and 25 mg samples were disrupted in QIAzol Lysis Reagent for 2 x 5 minutes at 25 Hz using the TissueLyser II. Total RNA containing miRNA was purified using the miRNeasy Mini Kit, using either the manual procedure (**Manual**) or the automated procedure with the QIAcube (**QIAcube**). Real-time RT-PCR using the miScript System was carried out to detect 2 different miRNAs, miR-16 and miR-25.

Ordering Information

Product	Contents	Cat. no.
TissueRuptor system — for low-throughput disruption		
TissueRuptor	Handheld rotor–stator homogenizer, 5 TissueRuptor Disposable Probes	Inquire
TissueRuptor Disposable Probes (25)	25 nonsterile plastic disposable probes for use with the TissueRuptor	990890
TissueLyser LT system — for low- to medium-throughput disruption		
TissueLyser LT	Bead mill; requires adapter (available separately)	85600
TissueLyser LT Adapter, 12-Tube	Adapter for disruption of up to 12 samples in 2 ml microcentrifuge tubes on the TissueLyser LT	69980
TissueLyser II system — for medium- to high-throughput disruption		
TissueLyser II	Bead mill; requires adapter set (available separately)	85300
TissueLyser Adapter Set 2 x 24	Adapter set for disruption of up to 48 samples in 2 ml microcentrifuge tubes on the TissueLyser II	69982
TissueLyser Adapter Set 2 x 96	Adapter set for disruption of up to 192 samples in Collection Microtubes (racked) on the TissueLyser II	69984
TissueLyser 3 mm Bead Dispenser, 96-Well	For dispensing 96 beads (3 mm diameter) in parallel	69973
TissueLyser 5 mm Bead Dispenser, 96-Well	For dispensing 96 beads (5 mm diameter) in parallel	69975
Collection Microtubes (racked)	960 x 1.2 ml tubes (nonsterile, polypropylene) in racks of 96	19560
Collection Microtube Caps (120 x 8)	960 caps (nonsterile, polypropylene) in strips of 8	19566
Accessories		
Stainless Steel Beads, 5 mm (200)	Stainless Steel Beads, suitable for use with TissueLyser systems	69989
Tungsten Carbide Beads, 3 mm (200)	Tungsten Carbide Beads, suitable for use with TissueLyser systems	69997
TissueLyser Single-Bead Dispenser, 5 mm	For dispensing individual beads (5 mm diameter)	69965
TissueLyser Single-Bead Dispenser, 7 mm	For dispensing individual beads (7 mm diameter)	69967

For up-to-date licensing information and product-specific disclaimers, see the respective QIAGEN kit handbook or user manual. QIAGEN kit handbooks and user manuals are available at www.qiagen.com or can be requested from QIAGEN Technical Services or your local distributor.

"RNA*later*®" is a trademark of AMBION, Inc., Austin, Texas and is covered by various U.S. and foreign patents.

Trademarks: QIAGEN®, QIAamp®, QIAcube®, QIAgility™, QIAsymphony®, QIAxcel®, QIAzol®, AllPrep®, BioRobot®, EZ1®, DNeasy®, GelPilot®, HotStarTaq®, Qproteome®, RNAprotect®, RNeasy®, TissueRuptor® (QIAGEN Group); Agilent® (Agilent Technologies, Inc.); Rotor-Gene® (Corbett Research Pty Ltd).

1056215 05/2009 © 2009 QIAGEN, all rights reserved.

www.qiagen.com

Australia ■ 1-800-243-800
Austria ■ 0800/281010
Belgium ■ 0800-79612
Brazil ■ 0800-557779
Canada ■ 800-572-9613
China ■ 0086-21-3865-3865
Denmark ■ 80-885945
Finland ■ 0800-914416
France ■ 01-60-920-930
Germany ■ 02103-29-12000
Hong Kong ■ 800 933 965
Ireland ■ 1800 555 049
Italy ■ 800-787980
Japan ■ 03-6890-7300
Korea (South) ■ 1544 7145
Luxembourg ■ 8002 2076
Mexico ■ 01-800-7742-639
The Netherlands ■ 0800 0229592
Norway ■ 800-18859
Singapore ■ 65-67775366
Spain ■ 91-630-7050
Sweden ■ 020-790282
Switzerland ■ 055-254-22-11
UK ■ 01293-422-911
USA ■ 800-426-8157