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diagenode

Innovating Epigenetics Solutions

BIORUPTOR®

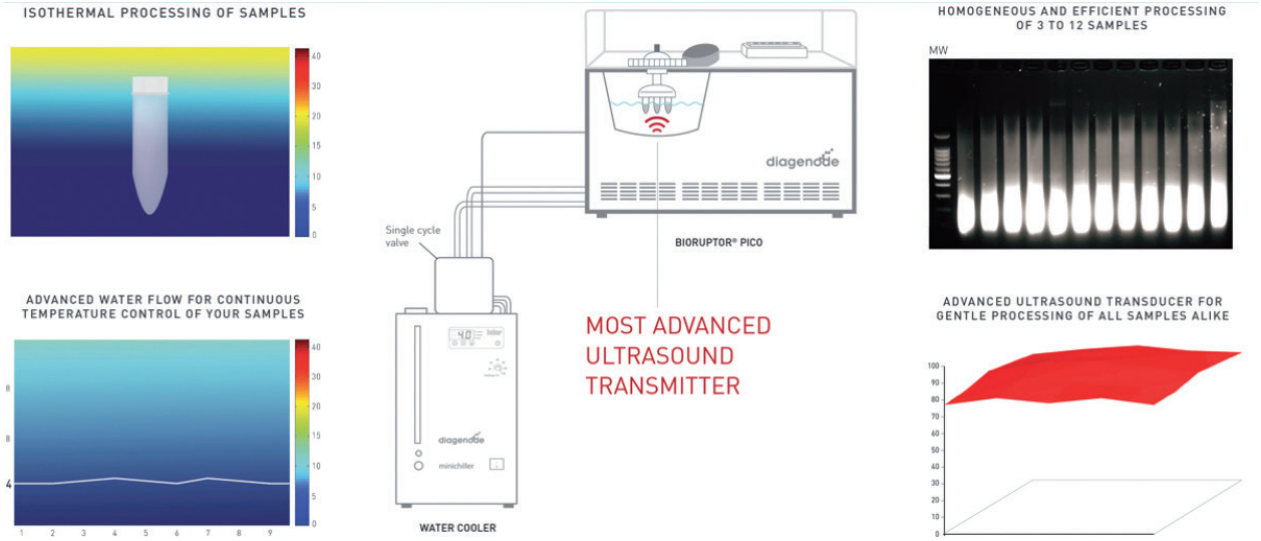
POWER FOR EVERY APPLICATION

STATE-OF-THE ART SHEARING DEVICE FOR:

- DNA and RNA shearing
- Chromatin shearing
- FFPE nucleic acid extraction
- Tissue and cell disruption
- Protein, DNA, RNA extraction

How the Bioruptor works

The Bioruptor Pico and Plus utilize a sonication bath-based rotor. The walls of the sonication bath reflect the ultrasound waves in a random but reproducible pattern. The samples in the tube holder are rotated through the ultrasound field to expose each sample to the same level and intensity of energy to ensure shearing consistency. A unique cooling system providing isothermal processing and the gentle ultrasound preserve and retain the integrity of biological samples and ensure high sample recovery.



Isothermal and homogeneous sample preparation with the Bioruptor

Left panels: Precise temperature control to maintain integrity in sample preparation. The single cycle valve and the 4°C water cooler deliver efficient cooling and reliable performance. Finite element analysis software modeling of temperature around the sample (upper panel). Sample temperature measured with Krystal MV64 thermocouple during sonication cycles (30''/30'' cycles) showing the perfect isothermal processing (lower panel).

Right panels: Powerful and uniform processing of samples down to 5 µl (12 samples) to large volumes of 2 ml (3 samples). Bioruptor empowers optimal and reproducible chromatin shearing while preserving high protein integrity (upper panel). The Bioruptor's most advanced ultrasound transmitter and water bath design ensure equal energy distribution. Cavitation energy, expressed as % of the maximum level, is measured with PPB Ultrasonic/Megasonic energy meter (lower panel).

A complete portfolio

Bioruptor® Plus

The Bioruptor Plus uniformly processes multiple samples in sealed tubes of 0.5 ml to 50 ml capacity. The powerful cooling system* (water cooler and single cycle valve) ensures high precision temperature control to protect samples.

The Bioruptor Plus is an excellent device for shearing chromatin, cell and tissue disruption prior to mass spectrometry analysis and many other applications.

- Easy to use
- Processing of 3 - 12 samples
- Sample size 100 µl - 20 ml
- Advanced timing control
- Temperature-controlled


CHROMATIN


PROTEIN


CHEMICAL

Bioruptor® Pico

The Bioruptor Pico is the latest innovation in shearing and represents a new breakthrough as an all-in-one shearing system optimized for homogeneous shearing micro-volumes of 5 µl to larger volumes of up to 2 ml. The powerful cooling system* (water cooler and single cycle valve) ensures high precision temperature control resulting in higher quality samples.

- All-in-one shearing solution
- Simultaneous sonication of 6-16 samples
- Ultra-low volumes of 5 µl to larger samples of up to 2 ml
- Advanced timing control
- Temperature-controlled


DNA


CHROMATIN


RNA

** Not shown in the picture*

Diagenode One

The Diagenode One is the new desktop solution that provides optimal DNA shearing for Next Generation Sequencing and Chromatin shearing for ChIP analysis with small samples. Designed to fit any bench, it is the smallest and lightest Diagenode shearing device. The fully integrated cooling system and the all-new 20 and 50 µl microfluidic chips have been enhanced to deliver the highest performance.

- Compact size
- Small volume DNA and chromatin shearing for optimal sample prep
- Fully integrated system

DNA

CHROMATIN

Megaruptor®

The Megaruptor 2 was designed to provide the best experience with the fragmentation of DNA from 3 kb - 75 kb. Shearing performance is independent of the source, concentration, temperature, or salt content of a DNA sample. Our user-friendly interface allows for two samples to be processed sequentially without additional user input and without cross-contamination.

- User-friendly software
- Tight fragment size distribution
- Hydropores eliminate clogging
- High quality ultra-long DNA librairies

DNA

Solutions for every application

PRODUCT	BIORUPTOR® PLUS	BIORUPTOR® PICO
DESCRIPTION	Best suited for cell and tissue sample preparation	Best suited for ChIP-seq and NGS sample preparation.
KEY APPLICATIONS	Chromatin shearing 200 bp - 1 kb DNA/RNA/Protein extraction Mass spectrometry Chemical applications	Chromatin shearing 200bp - 1kb DNA shearing 150bp - 1kb RNA shearing 200bp - 1kb FFPE nucleic acid extraction Cell lysis and tissue disruption
THROUGHPUT	12 (0.5 ml tube holder) 6 (1.5 ml tube holder) 6 (15 ml tube holder) 3 (50 ml tube holder)	12 (0.1 ml tube holder) 16 (0.2 ml tube holder) 12 (0.65 ml tube holder) 6 (1.5 ml tube holder) 6 (15 ml tube holder)
RECOMMENDED VOLUMES	100 µl (0.5 ml Bioruptor tubes) 100 - 300 µl (1.5 ml Bioruptor tubes) 300 µl - 2 ml (15 ml Bioruptor tubes) 2 - 20 ml (50 ml tubes)	5 - 50 µl (0.1 ml Bioruptor tubes) 20 - 100 µl (0.2 ml Bioruptor tubes) 100 µl (0.65 ml Bioruptor tubes) 100 - 300 µl (1.5 ml Bioruptor tubes) 300 µl - 2 ml (15 ml Bioruptor tubes)
TEMPERATURE CONTROLLED	✓	✓

DIAGENODE ONE	MEGARUPTOR®
The compact bench top device for optimal sample preparation	Ultimate solution for long read sequencing library preparation
Chromatin shearing 200 bp - 1 kb DNA shearing 200 bp - 1 kb	DNA shearing 3 kb - 75 kb (2 - 9 kb Hydropore Short and 10 - 75 kb Hydropore Long)
1 sample	2 samples (process in series)
20 and 50 µl	50 - 400 µl (hydrotubes)
✓	

Application versatility

FFPE nucleic acid extraction

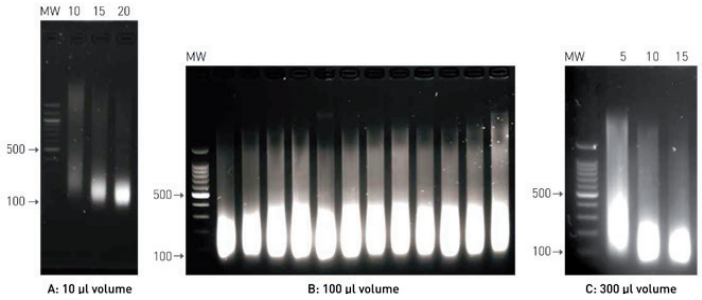
Deparaffinization of FFPE samples is typically performed using a non-polar solvent, such as xylene, or a mineral oil-based method which can be time consuming and messy. Using Diagenode's Bioruptor is a superior method for removing the paraffin and rehydrating FFPE tissues in just one solvent-free step followed by a mild crosslink reversal to preserve DNA and RNA integrity.

Efficient deparaffinization of FFPE sections by sonication with Bioruptor

10 µm sections were sonicated for 3 cycles (30 sec ON/OFF at RT) with the Bioruptor Pico. The paraffin has been emulsified and completely dissociated from the tissue section.

Chromatin shearing

The most important steps for a successful ChIP include both cell fixation and lysis, and chromatin shearing. Diagenode's Bioruptor uses state-of-the-art ultrasound technology to give the highest chromatin quality for high IP efficiency and sensitivity for ChIP experiments with gentle yet highly effective shearing forces. Additionally, the Bioruptor provides a precisely controlled temperature environment that preserves chromatin from heat degradation such that protein-DNA complexes are well-preserved for sensitive, unbiased, and accurate ChIP.



Diagenode's Bioruptor is the instrument of choice for chromatin shearing used for a number of downstream applications such as qPCR and ChIP-seq that require optimally sheared, unbiased chromatin

Panel A, 10 µl volume: Chromatin samples are sheared for 10, 20 and 30 cycles of 30 sec ON/30 sec OFF with the Bioruptor Pico using 0.1 ml Bioruptor Microtubes (Cat. No. B01200041).

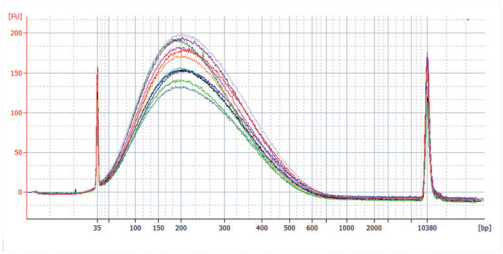
Panel B, 100 µl volume: Chromatin samples are sheared for 10 cycles of 30 sec ON/30 sec OFF with the Bioruptor Pico using 0.65 ml Bioruptor Microtubes (Cat. No. WA-005-0500).

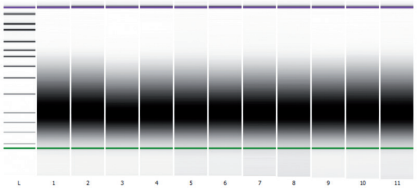
Panel C, 300 µl volume: Chromatin samples are sheared for 5, 10 and 15 cycles of 30 sec ON/30 sec OFF with the Bioruptor Pico using using 1.5 ml Bioruptor microtubes (Cat. No. C30010016). Prior to de-crosslinking, samples are treated with RNase cocktail mixture at 37°C during 1 hour. The sheared chromatin is then de-crosslinked overnight and phenol/chloroform purified as described in the kit manual. 10 µl of DNA (equivalent of 500,000 cells) are analyzed on a 2% agarose gel (MW corresponds to the 100 bp DNA molecular weight marker).

DNA shearing

Next Generation Sequencing (NGS) has revolutionized genomics and biology. One of the most critical aspects of optimal library preparation is the quality of the DNA to be sequenced. The DNA must first be effectively and consistently sheared into the appropriate fragment size (depending on the sequencing platform) to enable sensitive and reliable NGS results. The Bioruptor and the Megaruptor provide superior sample yields, fragment size, and consistency, which are essential for Next Generation Sequencing workflows.

A





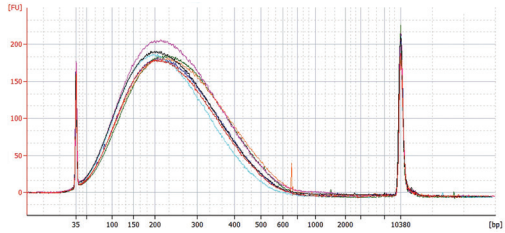
Sample volume: **100 µl**

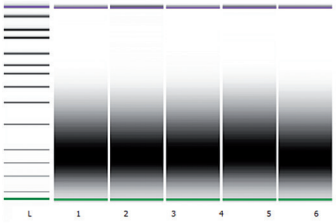
Microtubes: **0.65 ml**

Sonication cycles:
13 cycles (30 sec ON/OFF)

Average size:
204 bp; CV%: 1.89%

B





Sample volume: **10 µl**

Microtubes: **0.1 ml**

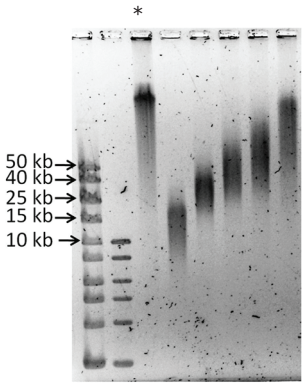
Sonication cycles:
20 cycles (30 sec ON/OFF)

Average size:
215 bp; CV%: 6.6%

Programmable DNA size distribution and high reproducibility with Bioruptor Pico

Image shows peak electropherogram view (left), virtual gel view (center) and shearing conditions (right).

A



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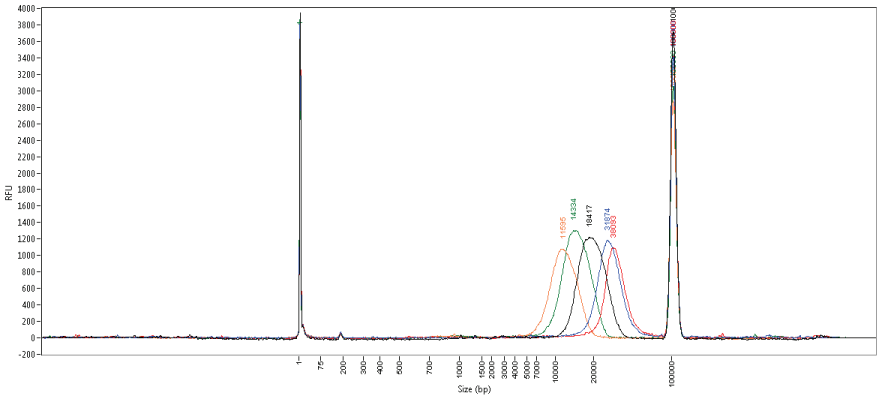


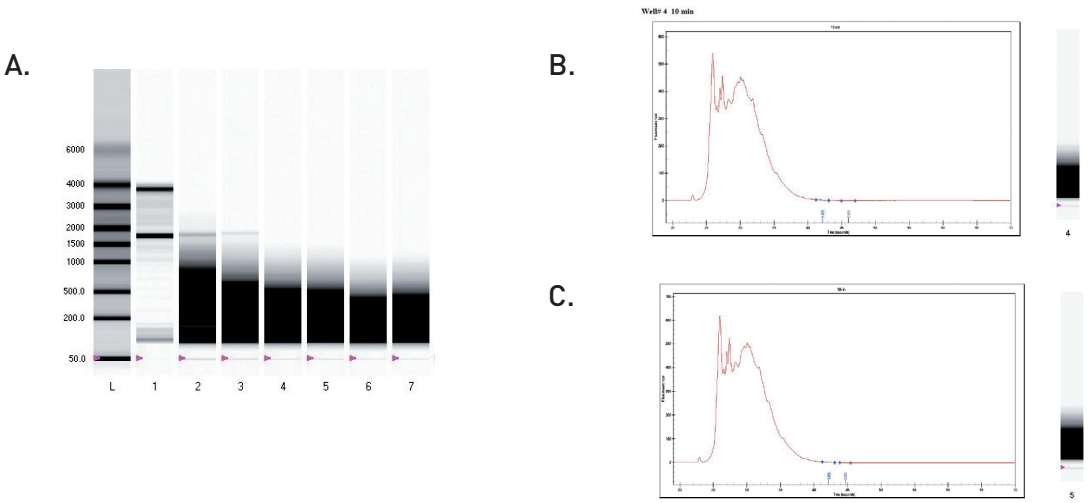
Demonstrated shearing to fragment sizes between 10 kb and 75 kb with Megaruptor using long fragment size Hydropores

Image shows DNA size distribution of human genomic DNA sheared with long fragment Hydropores. **A:** DNA was analyzed by pulsed field gel electrophoresis (PFGE) in 1% agarose gel and a mean size of smears was estimated using Image Lab 4.1 software. **B:** Fragment Analyzer profiles of human genomic DNA (25 ng/µl; 200 µl/sample) sheared at different software settings of 10, 15, 20, 30 and 40 kb. (High Sensitivity Large Fragment Analysis Kit; Advanced Analytical Technologies, Inc. was used for separation and fragment sizing).

** indicates unsheared DNA*

RNA shearing

RNA sequencing is a highly accurate and sensitive method to obtain unprecedented information about the transcriptome. The RNA must be fragmented to an appropriate size for sequencing prior to reverse transcription. The Bioruptor provides unbiased RNA shearing for best cDNA synthesis and ensures high quality Next Generation Sequencing.

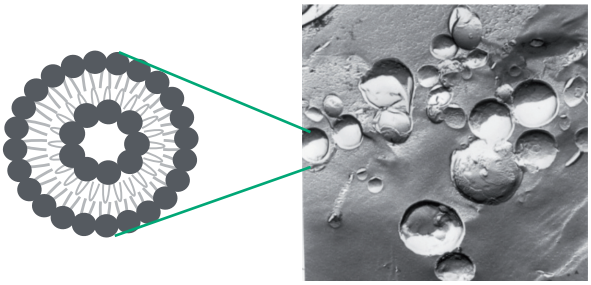


Programmable RNA size distribution and excellent reproducibility with Bioruptor

The various panels show different RNA size distributions of sheared total RNA produced by varying the duration of sonication on the Bioruptor. Panel A shows duplicate profiles produced after 5 (lanes 2-3), 10 (lanes 4-5) and 15 minutes (lanes 6-7) (30 sec on/off) of sonication. Lane 1 shows the unfragmented total RNA (starting material). Panel B and C compare the RNA size distributions of sheared total RNA from 2 different experiments. All samples were analysed on Biorad Experion using Eukaryote Total RNA HighSens chip.

Liposome preparation

Sonication is one of the most common methods employed for liposome preparation. The Bioruptor provides high throughput and reproducibility and eliminates the need for direct contact to prevent sample contamination. The precise temperature control preserves the lipids from damage through overheating or oxidation.

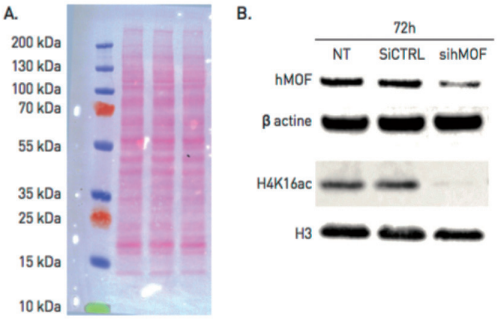


Size reduction of multilamellar vesicle

Peter Stone and Yvonne Perrie from Aston University and University of Strathclyde process MLV generated using the thin film lipid hydration method with the Bioruptor. The 100 µl samples are sonicated 15 minutes at 45°C in the Bioruptor Plus with high power for rapid small scale production of bilayer -loaded liposomes.

Protein extraction

Various biochemical and analytical techniques require the extraction of protein from tissues or mammalian, yeast and bacterial cells. Obtaining high quality and yields of proteins is important for further downstream protein characterization such as in PAGE, western blotting, mass spectrometry or protein purification. The efficient disruption and homogenization of tissues and cultured cells obtained in just one step using Diagenode's Bioruptor delivers high quality protein.

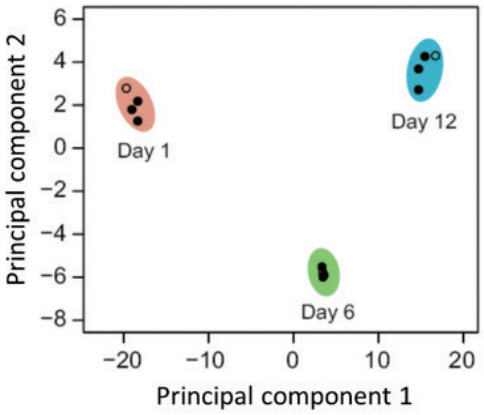


Simultaneous extraction of cytoplasmic, nuclear and chromatic proteins

Protein staining of cell lysates (containing both chromatin and soluble proteins) obtained with the protocol developed by Lauriane Fritsch from the laboratory of Slimane AIT-SI-ALI.

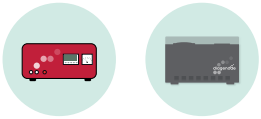
A. Ponceau S Staining Western Blot of Hep G2 cells lysates obtained usting the Bioruptor. The rectangle indicates the location of histones.

B. Western Blot of Hep G2 cells transfected and cultivated for 72h with siRNA against hMOF, a histone h4 K16-specific acetyl transferase. Both soluble (hMOf and B-actine) and chromatin (Histone 3 and 4) proteins are obtained on the same cell extract.



Most reliable and reproducible method to prepare lysates from *C. elegans*

Prasad Kasturi and F Ulrich Hartl at the Max Plank Institute for Biochemistry are using the Bioruptor for their research using *C. elegans*. SILAC quantitative proteomics showing the high reproducibility of proteome analysis in multiple replicates of worm samples of different ages (adopted from Walther DM and Kasturi P et al., Cell. 2015).



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