

Applied Biosystems 1700 Chemiluminescent Microarray Analyzer

The Applied Biosystems 1700 Chemiluminescent Microarray Analyzer is a component of the integrated Applied Biosystems Expression Array System, which uses the power and sensitivity of chemiluminescence to identify and measure gene expression levels in cells and tissues.

Designed to incorporate a state-of-the-art CCD camera, the 1700 analyzer precisely images the chemiluminescent signal that results when labeled transcripts are hybridized to a microarray. In addition, the 1700 analyzer images the microarray in a fluorescent mode to grid, normalize, and identify microarray features with pinpoint accuracy, even in the absence of gene expression products binding to the microarray probes.

Automated and highly sensitive, the 1700 analyzer is supplied with an Oracle® database containing the latest gene annotation data that is essential for all laboratories engaged in today's gene expression studies. The database also provides full storage and query access for all experimental data.

System Chemistry and Workflow

The Applied Biosystems 1700 Chemiluminescent Microarray Analyzer is optimized for use with Applied Biosystems microarrays and the following three reagent kits:



Figure 1. The Applied Biosystems 1700 Chemiluminescent Microarray Analyzer provides sensitive chemiluminescence and fluorescence detection for gene expression research.

1. Applied Biosystems Chemiluminescent RT Labeling Kit

This kit converts mRNA from cells into digoxigenin-labeled cDNA.

2. Applied Biosystems Chemiluminescent RT-IVT Labeling Kit

Alternatively, this kit converts mRNA from cells into digoxigenin-labeled cRNA while simultaneously and linearly amplifying input RNA.

The resultant digoxigenin-labeled cDNA or cRNA is specifically hybridized to the Applied Biosystems microarray.

3. Applied Biosystems Chemiluminescence Detection Kit

When unbound materials have been washed from the microarray, the Applied Biosystems Chemiluminescence Detection Kit is used to visualize features that have digoxigenin-labeled cDNA or cRNA bound to the oligonucleotide probes. Visualization is achieved by incubating the microarray with an anti-digoxigenin alkaline phosphatase conjugate. Alkaline phosphatase hydrolyzes a chemiluminescent substrate and emits light at a wavelength of ~458 nm. The signal intensity is proportional to the mRNA level expressed in the cells.

Locating Features on the Microarray

Also present during hybridization is a 24-mer oligonucleotide labeled with the fluorescent LIZ[®] dye. This oligonucleotide is complementary to one that is co-deposited at microarray features during manufacture of Applied Biosystems microarrays. The fluorescent signal, which has a close spatial correlation with the chemiluminescent signal, locates all features on the microarray, even in the absence of gene expression products.

Human Genome Survey Microarray

Applied Biosystems microarrays are sealed in a pre-assembled cartridge and contain oligonucleotides with a feature diameter of < 180 μm , and a space of > 45 μm (edge-to-edge) between each feature. The oligonucleotides target transcripts in each gene of the human genome. Oligonucleotide probes are synthesized at Applied Biosystems and designed to ensure maximal specificity. Prior to microarray manufacture, all probes undergo analysis by mass spectrometry for quality control.

Microarray Manufacturing Process

The microarray manufacturing process involves covalent attachment of the oligonucleotide probes to a derivatized nylon substrate that is backed by a glass slide. The porous substrate was expressly developed for this application. Deposition and covalent binding of oligonucleotides results in three-dimensional (3-D) features. These 3-D features, combined with the low chemiluminescence background and low noise imaging of the 1700 analyzer, contribute to the overall the system sensitivity.

Each microarray plastic cartridge has a sample loading port that can be easily resealed after the addition of



Figure 2. The Applied Biosystems Human Genome Survey Microarray.

Imaging System Specifications

Quantum efficiency	0.75 electrons/photon
CCD camera format	27.6 mm x 27.6 mm
Magnification	0.63
Read noise	8 electrons/pixel (typically)
Dark current	0.1 electron/pixel/second (cooled to -50°C to minimize the dark current)
Resolution	4.194 million pixels imaging simultaneously on a field measuring 26.85 mm x 35.68 mm, equivalent to 21.3 μm x 21.3 μm per pixel
Optics	Two high-quality, medium-format photographic lenses
Chemiluminescent target channel center emission wavelength	~458 nm
Fluorescent channel* center emission wavelength	~658 nm
1700 analyzer stage temperature	Constant 35°C (\pm 1°C) during data collection

*For feature finding and autofocus

labeled cDNA or cRNA. When hybridization is complete, the cartridge is disassembled and discarded. The microarrays are then processed in batches and the unbound material is washed away.

CCD Camera

The 1700 analyzer is equipped with a high-resolution, large-format CCD camera. The cooled CCD is back-illuminated for high efficiency and has very low read noise. This, coupled with the low background from chemiluminescence, results in very high sensitivity.

System Components

Software-Controlled Microarray Analyzer

Captures up to six high-resolution images per microarray; has built-in autofocus adjustment.

Barcode Reader and Software

Provides easy tracking of samples, reagents, and microarrays.

Router

Creates an instrument LAN, which can be interfaced to a user-supplied network to enable remote-client access. Up to five clients can have access to all data.

Computer

The mini-tower computer for the 1700 analyzer is manufactured by Dell® Computer Corporation and is configured with the following:

- Windows® 2000 Professional, Service Pack 3* Operating System
- Oracle® 9i Database
- Intel® Pentium® IV 3.0 GHz* processor
- 800 MHz* FSB (front side bus)
- 1 GB* RAM
- Two installed IDE hard drives; 120 GB, 7,200 RPM*
- 64 MB NVIDIA® Video Card
- CD-RW/DVD-ROM Combo Drive
- Floppy Disc Drive
- 17-inch flat panel LCD monitor
- Onboard network interface card
- SMC Networks Router
- 115 V/230 V* (voltage switch is preset to 230 V on power supply)

*Minimum PC operating/hardware requirements

Data Acquisition Cycle

Images Per Microarray Analysis	Image Function	Exposure Length
16 images (typically)	Autofocus	2 minutes total (typically)
2 "short" chemiluminescent images	Coarse image analysis, QA/QC, and gene expression	5 seconds each
2 "long" chemiluminescent images	Gene expression	25 seconds each (default) 5-500 seconds (programmable)
2 fluorescent images	Feature finding	25 seconds each

System Performance

Human Genome Survey Microarray	RT-IVT Labeling Kit	RT Labeling Kit
Features	34,656	34,656
Recommended amount of labeled cRNA/cDNA for hybridization	10 µg	10 µg
Sample amount ¹	1 µg	40 µg
Number of genes w/signal-to-noise ² > 3	> 16,000	> 16,000
Sample amount ²	0.1 µg	10 µg
Number of genes w/signal-to-noise > 3	> 10,000	> 10,000
Limit of detection ³	50 fM	10 fM
Fold change precision in highest 30% of signal range	1.6	1.6
Fold change precision in lowest 30% of signal range	2.0	2.0
Linear dynamic range	> 1,000	> 1,000

¹Minimum amount of total RNA needed to generate enough labeled material for one microarray experiment using Stratagene Universal Human Reference RNA.

²Number of genes detected in Stratagene Universal Human Reference RNA using 0.5 µg of total RNA as input into RT-IVT labeling kit (P/N 4340472) or 40 µg of total RNA as input into RT labeling kit (P/N 4340415).

³Concentration of spike-in cDNA or cRNA with signal > 3 SD above no-template control.

Training, Installation, and Warranty

Purchase price includes installation and applications training by highly trained Applied Biosystems Service Representatives, and a one-year limited warranty on parts and labor.

Worldwide Applications Support

Worldwide applications support and service is offered from Applied Biosystems expert technical specialists and scientists.

Specifications for the 1700 Analyzer

Operating Environment

Temperature 15°C – 30°C (should not fluctuate $\pm 2^\circ\text{C}$ while instrument is running)

Humidity 20% – 80% (non-condensing)

Power Requirements

Main Power Voltage 100–140 V or 230–240 V ($\pm 10\%$), 50–60 Hz ($\pm 10\%$)

Current Maximum 4A

Maximum Power Dissipation ~350W

Dimensions

Depth 70 cm (28 inches); 95 cm (38 inches) with door open

Width 54 cm (22 inches)

Height 77 cm (31 inches)

Weight ~80 kg (177 lb)

Ordering Information

Description	Quantity/Use	P/N
Applied Biosystems 1700 Chemiluminescent Microarray Analyzer		4338036
Microarrays		
Applied Biosystems Human Genome Survey Microarray (single use)	4/box	4337467
Applied Biosystems Human Genome Survey Microarray (single use)	12/box	4337468
Applied Biosystems Mouse Genome Survey Microarray (single use)	4/box	4345065
Applied Biosystems Mouse Genome Survey Microarray (single use)	12/box	4345064
Reagent Kits		
Applied Biosystems Chemiluminescent RT Labeling Kit	12 reactions	4340415
Applied Biosystems Chemiluminescent RT-IVT Labeling Kit	12 reactions	4340472
Applied Biosystems Chemiluminescence Detection Kit	12 reactions	4342142



iScience. To better understand the complex interaction of biological systems, life scientists are developing revolutionary approaches to discovery that unite technology, informatics, and traditional laboratory research. In partnership with our customers, Applied Biosystems provides the innovative products, services, and knowledge resources that make this new, **Integrated Science** possible.

Worldwide Sales Offices

Applied Biosystems vast distribution and service network, composed of highly trained support and applications personnel, reaches 150 countries on six continents. For international office locations, please call the division headquarters or refer to our Web site at www.appliedbiosystems.com

Applera Corporation is committed to providing the world's leading technology and information for life scientists.

Applera Corporation consists of the Applied Biosystems and Celera Genomics businesses.

Headquarters

850 Lincoln Centre Drive
Foster City, CA 94404 USA
Phone: 650.638.5800
Toll Free: 800.345.5224
Fax: 650.638.5884

For Research Use Only.
Not for use in diagnostic procedures.

Applied Biosystems and LIZ are registered trademarks, and AB (Design), Applera, iScience, and iScience (Design), are trademarks of Applera Corporation or its subsidiaries in the US and/or certain other countries.

Dell is a registered trademark of Dell Computer Corporation.

Oracle is a registered trademark of Oracle Corporation. Intel and Pentium are registered trademarks of Intel Corporation.

NVIDIA is a registered trademark of NVIDIA Corporation.

Windows is a registered trademark of Microsoft Corporation

©2004 Applied Biosystems. All rights reserved. Information subject to change without notice.

Printed in the USA, 08/04
P+s, Publication 130SP01-03