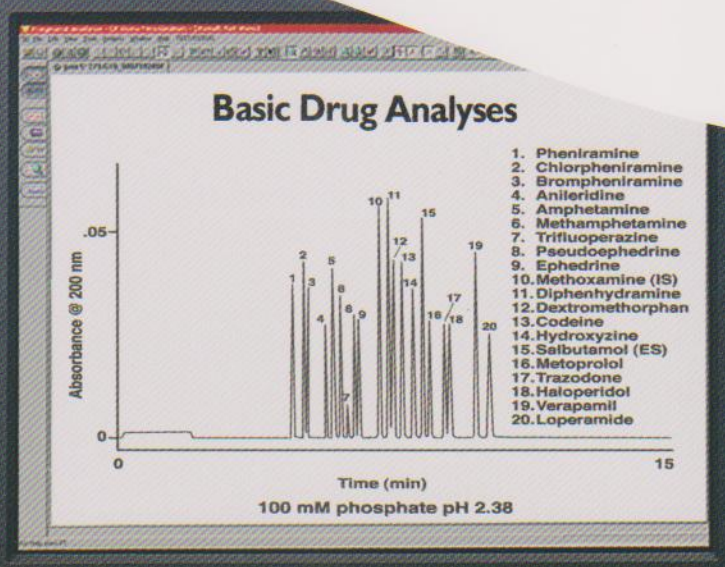
BR-8177C

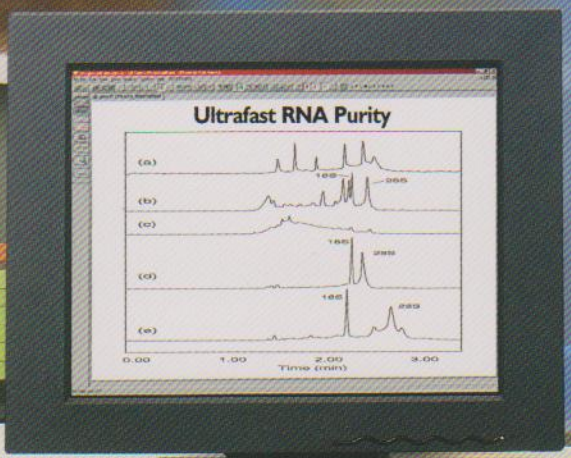
BECKMAN COULTER

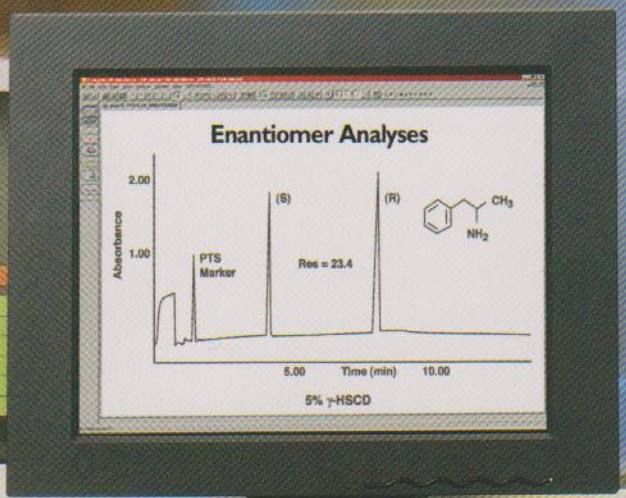
*CE. It's working everywhere you are.*

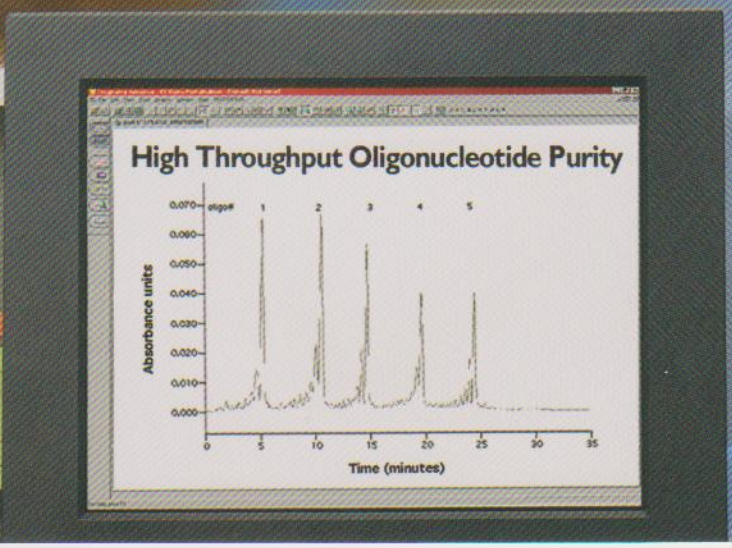
# P/ACE™ MDQ

## Capillary Electrophoresis System



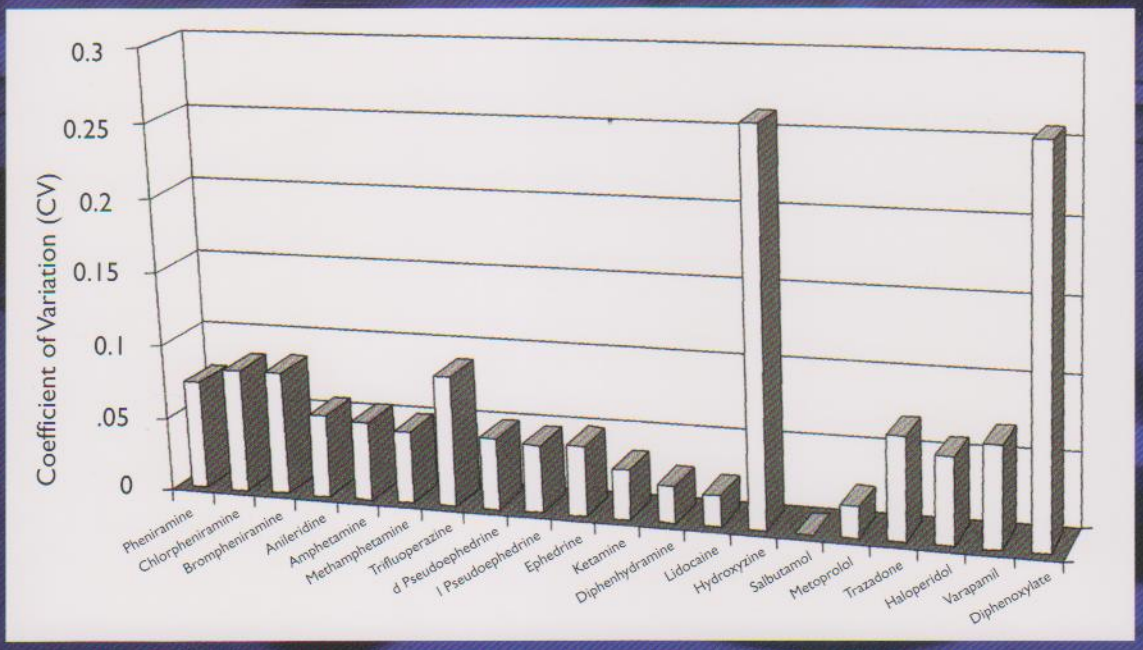



## *A legacy of innovation.*

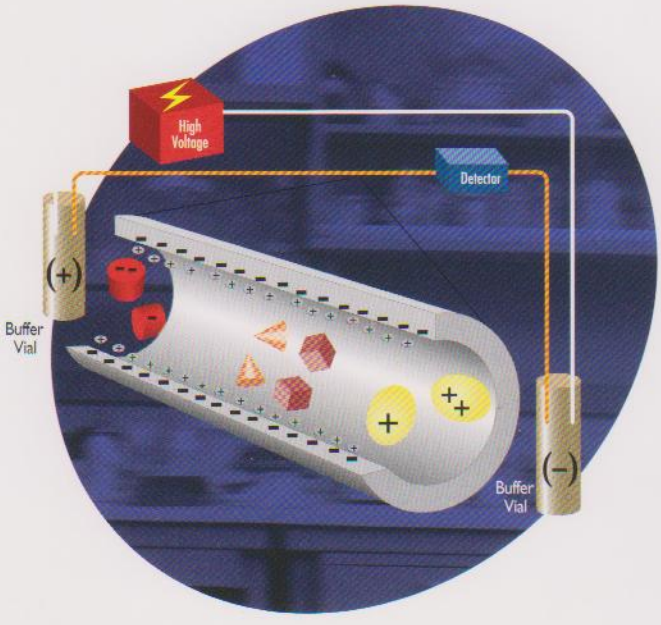
Ever since we introduced the first ground-breaking P/ACE™ system in 1989, we've led the industry in CE technologies and tools. Our developments encompass hardware, software and chemistries, with a long list of advancements that include laser-induced fluorescence, diode array detection, advanced CE data reduction, and many CE chemistries. Always directed by your needs, we continue to focus on leadership, and on new ways to apply the core technology to key analytical solutions.

## *Precision of mobility.*

In capillary electrophoresis, an analyte's mobility is the driving force behind its separation. The mobility of a compound in solution is a function of its mass and charge, and is an excellent parameter to evaluate the impact of molecular interactions, while removing the variability of electrosmotic flow (EOF). Because this parameter is unique to a compound, it may be used effectively for identification.




*Reproducibility of mobility determinations on the P/ACE MDQ. 17-week, inter-capillary study – P/ACE Setter Vol 2, Issue 4, 1998*

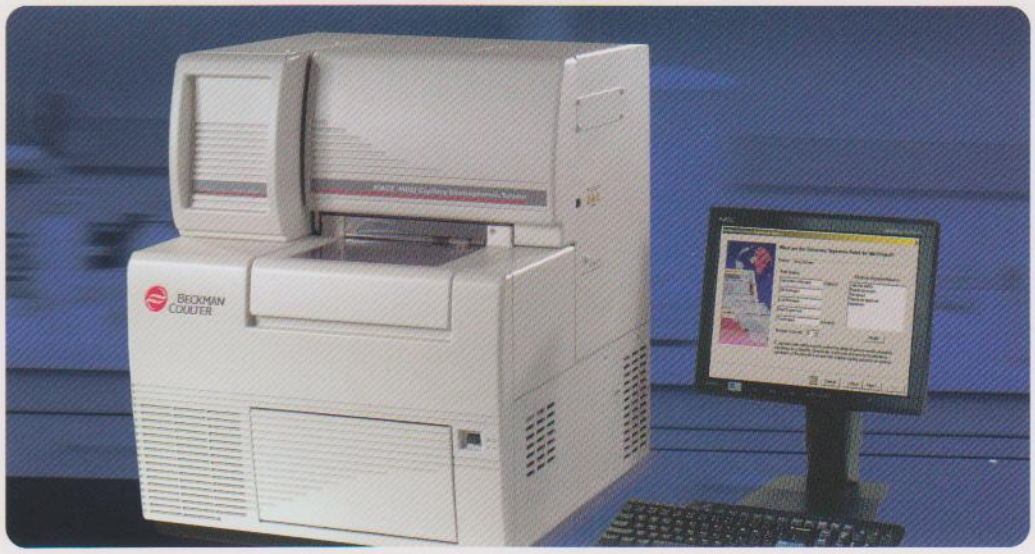


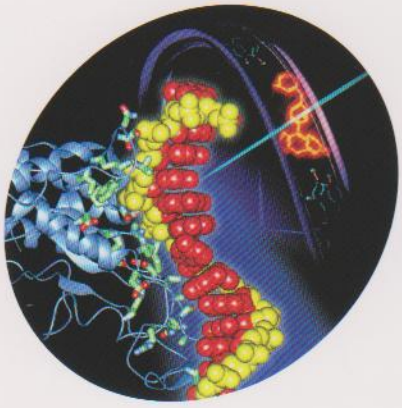

## *The world of CE technology.*

Capillary electrophoresis (CE) technology is employed in a series of related separation techniques that use narrow-bore fused-silica capillaries to separate a complex array of large and small molecules. Depending on the types of capillary and buffers used, CE can be segmented into:

- Capillary Zone Electrophoresis (CZE)
- Capillary Gel Electrophoresis (CGE)
- Capillary Isoelectric Focusing (CIEF)
- Isotachophoresis (ITP)
- Electrokinetic Chromatography (EKC)
- Micellar Electrokinetic Capillary Chromatography (MECC)
- Capillary Electrochromatography (CEC)
- Non Aqueous Capillary Electrophoresis (NACE)

Because of its unique, modular design, the P/ACE™ MDQ is ideal for research, methods development and quality control applications. The system can be rapidly reconfigured from a flexible research platform to a tightly regulated routine use platform.



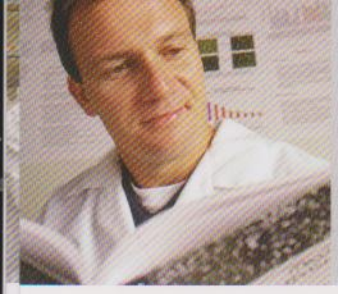
## *Robust technology.*

CE is utilized in many different industries, including basic biological research, pharmaceutical and biotechnology development, forensic and environmental science. Its popularity can be attributed to its simplicity, reliability, speed and versatility, combined with low operating costs and minimal waste production.

**Beckman Coulter's Family of CE Technology**

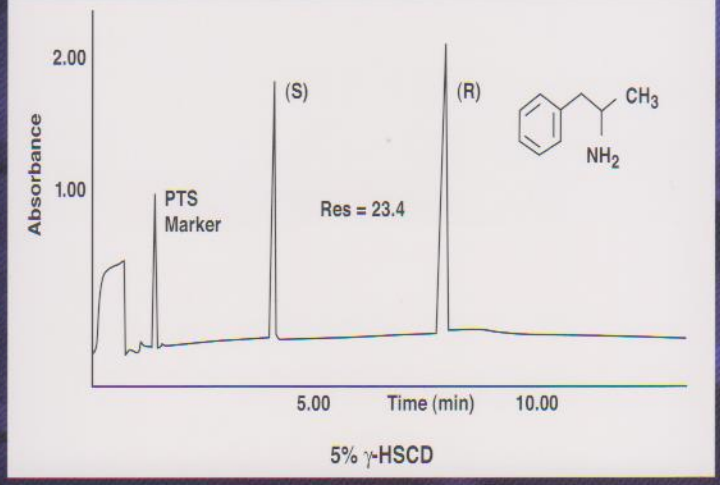
- **P/ACE MDQ Series CE Systems**
- **ProteomeLab™ Protein Characterization System**
- **CEQ™ Series Genetic Analysis Systems**
- **Paragon® CZE 2000 Serum Protein Analyzer**

At Beckman Coulter, we're continuing to develop this powerful and robust technology across a variety of platforms, and apply it to specific applications solutions. Through aggressively pursuing innovative new directions, we're firmly committed to furthering the state of the technology, and delivering the products you need both now and into the future.



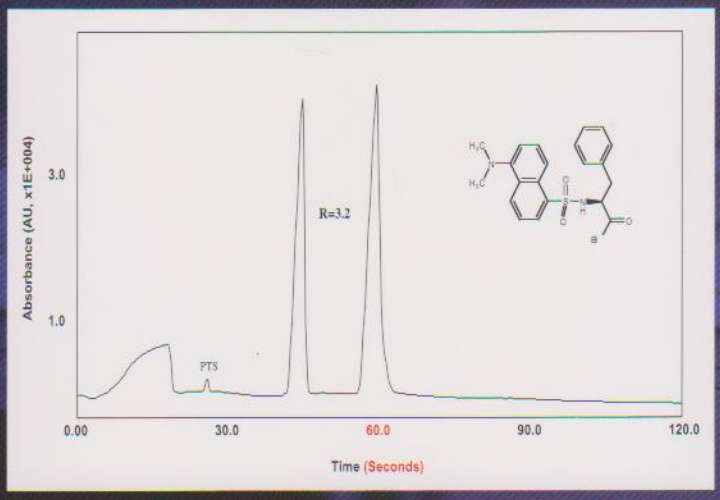
# *Putting CE to work.*

Developing innovative solutions for the laboratory begins with a solid understanding of our customers, their processes and daily challenges. Combined with our state-of-the-art technology and leading-edge science, this knowledge produces total systems solutions that streamline and expedite every step of sample processing – preparation, analysis, result reporting, and data archiving.



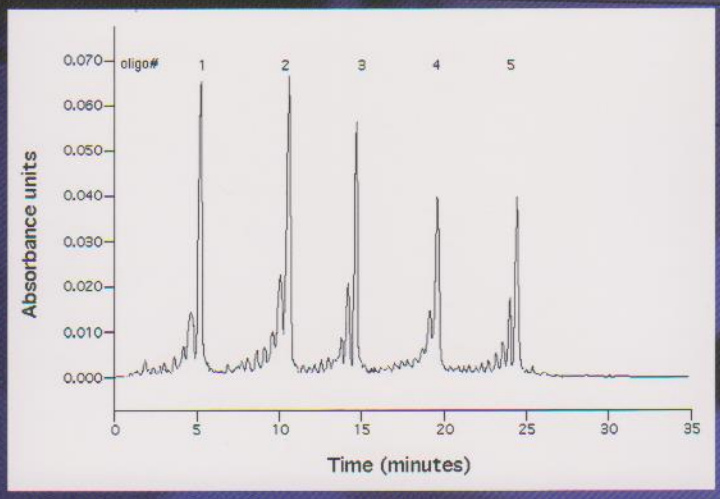

## *Enantiomer analysis.*

The construction of a chiral environment in capillary electrophoresis is achieved by simply filling the capillary with a buffer containing a chiral additive. Although many chiral selectors have been used, the most comprehensive and effective separation strategies have been achieved with sulfated cyclodextrins. The adjacent graph illustrates the separation of amphetamine enantiomers using this approach, and highlights the degree of enantiomer resolution which may be achieved with these selectors.




## *Simplified methods development.*

Our chiral methods development strategy uses a family of highly sulfated cyclodextrins that have been developed and formulated to functional specifications for enantiomer analysis, thus ensuring a reliable commercial supply of enantiomer selectors. This methods development strategy uses a single separation with α, β and γ highly sulfated cyclodextrins to resolve acidic, basic, neutral and zwitterionic pharmaceuticals. And by simply reversing the sample introduction to the other side of the capillary, very rapid separations can be generated using only a 10 cm length. The adjacent graph illustrates the rapid analysis of phenylalanine enantiomers in less than one minute.

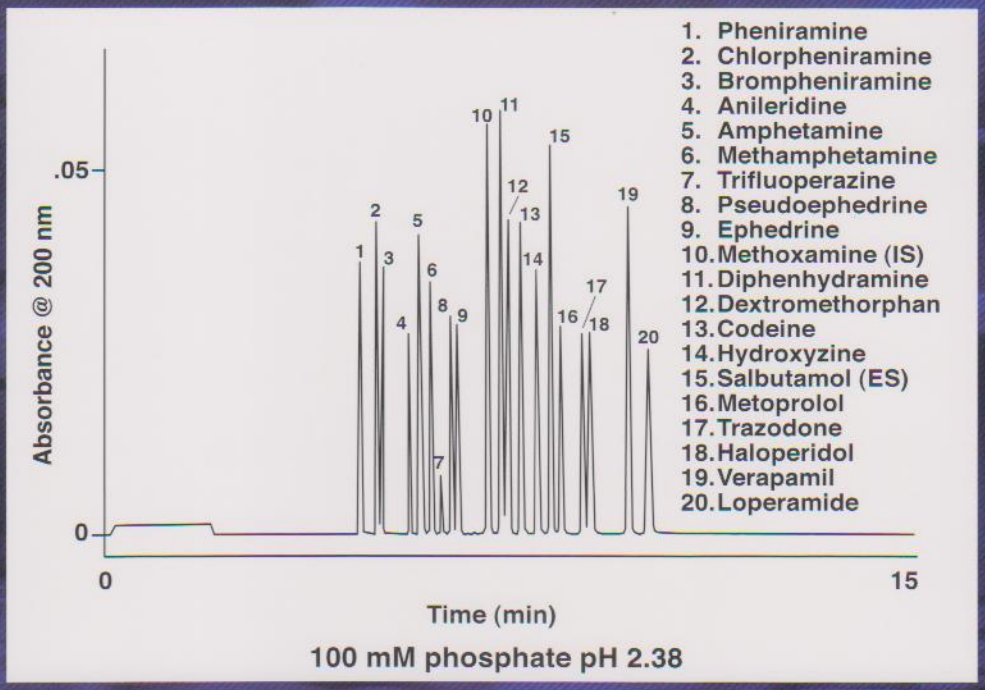



## *Genetic analysis.*

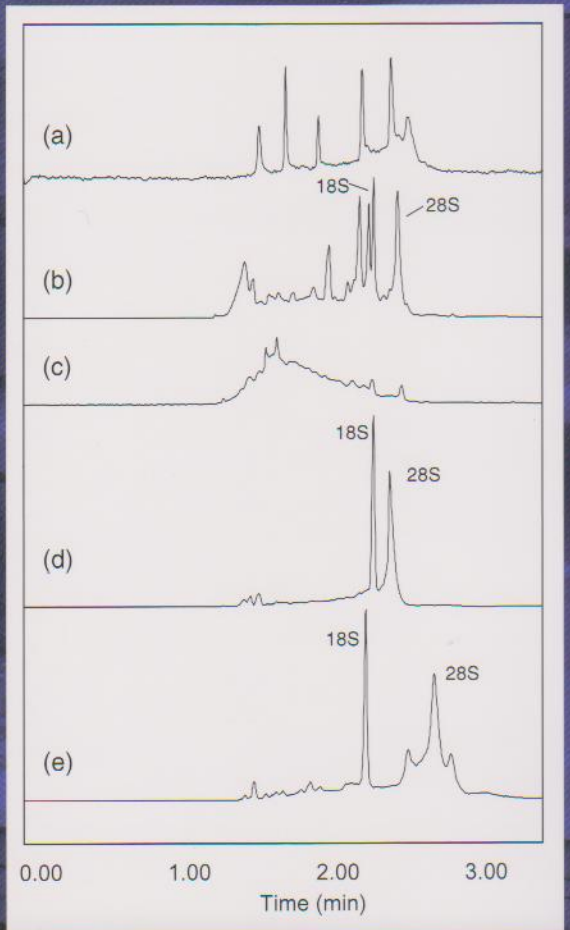
By simply introducing a polymer into the separation buffer, you can rapidly create a physical gel (entangled polymer network) to provide a size-based separation of nucleic acids. This approach – known as capillary gel electrophoresis (or CGE) – has provided an automated and quantitative replacement of gel electrophoresis for oligonucleotide quality control, RNA purity analysis, plasmid heterogeneity analysis, gene expression studies, and the analysis of DNA/protein interactions. Shown here is purity analysis of multiple oligonucleotides using a high-throughput mode known as serial injection before analysis (SIBA).

## *Drug screening.*

While the highly polar nature of basic pharmaceuticals makes chromatography complex, CE has the ability to excel at such separations. This figure shows the analysis of 20 basic drugs using low pH, where the capillary surface is essentially neutral and the amine functional groups on the solutes are maximally ionized. The robust nature of this tool and the ruggedness of this particular approach are appropriate for screening protocols used in drug discovery and forensic toxicology.




When capillary electrophoresis was introduced, it was seen as a revolutionary technique. Now, it's fulfilling a role as a workhorse in analytical laboratories. In fact, CE should be considered first when dealing with highly polar, charged analytes. It has excelled in the rapid analysis of ions, and become predominant for impurity analysis of basic and chiral pharmaceuticals.




## *Ultrafast RNA purity analysis.*

Messenger RNA pools are widely used for cDNA library generation, creation of expressed sequence tag (EST) databases, and gene expression profiling. However, the quality of this RNA is an important consideration, as these molecules are highly susceptible to degradation by naturally contaminating RNAases. The P/ACE MDQ with laser-induced fluorescence (LIF) detection may be used for the unattended processing of total RNA from 96-well plates, followed by automated and quantitative data analysis, with only a 5-minute cycle time per run (3 minutes separation and 2 minutes matrix replacement). Electropherogram of RNA sample shown are: (a) RNA 6000 Ladder size standard; (b) Intact total RNA extracted from rice; (c) Degraded total RNA from rice; (d) Intact total RNA from yeast; (e) Intact total RNA from mouse.

## *Ready for a world of applications.*

Our CE leadership has established the largest productive base of CE instruments and users in the world. And our product development has been guided by suggestions from this large customer base, as well as collaborative work with experts in the field. From this input, we've developed a modular P/ACE MDQ system, effectively applying CE technology to resolving real-world separations.

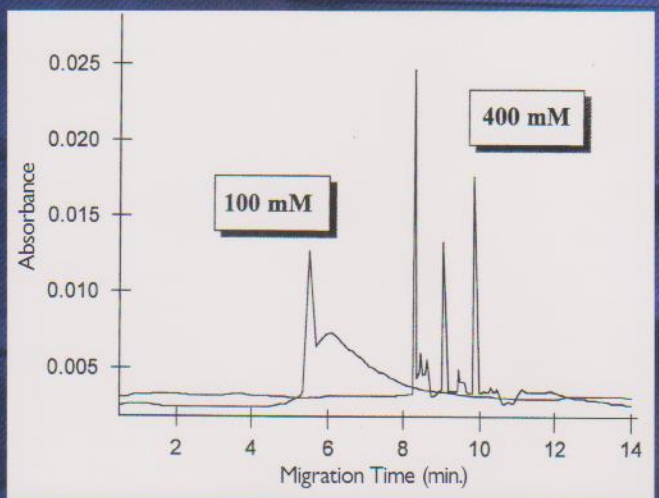
## *Modular platform, for enhanced flexibility.*

Because P/ACE MDQ is designed as a combination of integrated modules, it can easily be configured to run a wide variety of procedures, fast and efficiently. Which means that from research and methods development to quality control, it can adapt to the specific demands of different applications.

## *Temperature control.*

Beckman Coulter's patented capillary liquid cooling system is much more efficient than simple air cooling. A few of its primary advantages include:

- Use of high ionic strength running buffers (500 mM) to improve resolution of complex samples
- Use of large bore (150-200 µm i.d.) capillaries to accommodate larger mass loads and enhance sensitivity
- Improved migration time reproducibility

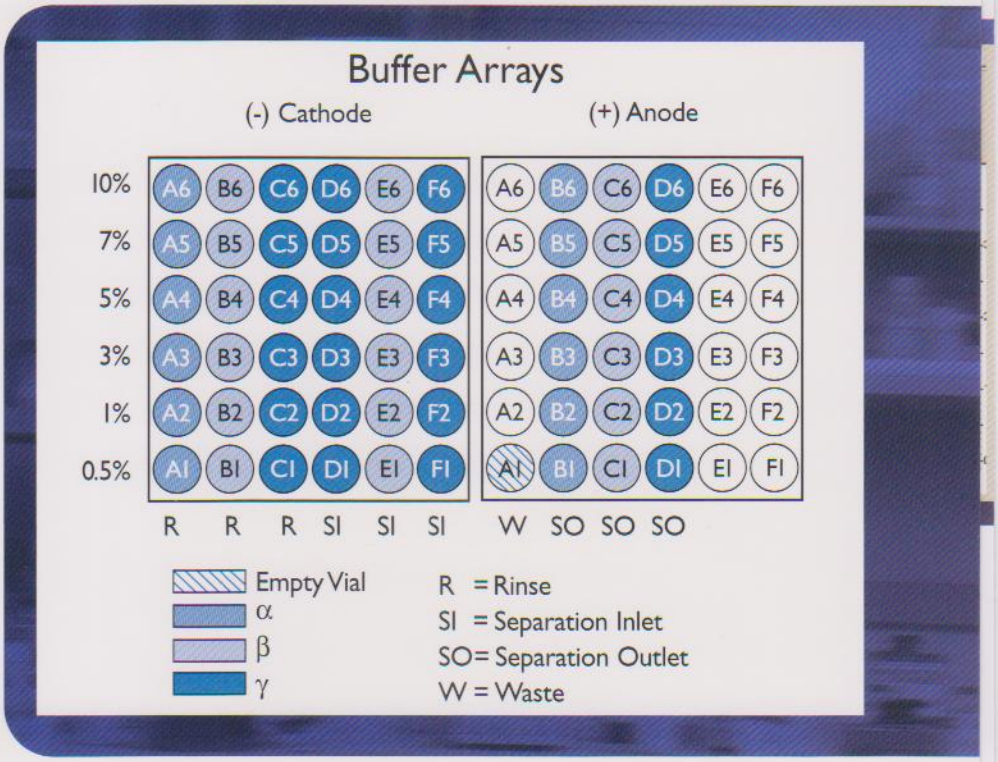


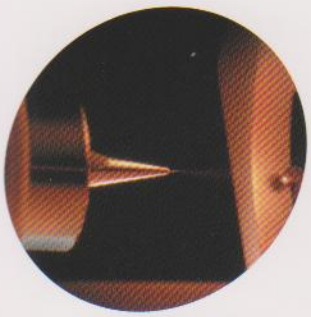

*Complex sample matrices require high ionic strength separation buffers for optimum resolution. The P/ACE MDQ's liquid temperature control system allows the use of these buffers without the problems associated with excessive joule heating.*

## *Automation.*

An array of up to 36 pairs of buffers accessed randomly provides flexibility in optimizing methods development. This buffer array allows automation of the methods development process through the implementation of separation strategies, in that you can easily have the system test an array of different buffer pH levels, ionic strengths or additives. Once the method is developed, the array may be replaced with large-volume buffer reservoirs for routine analysis.

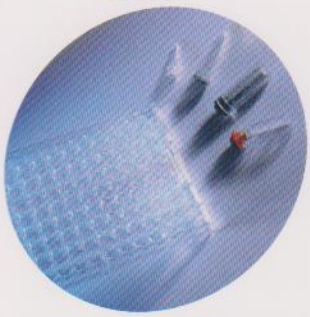
Reproduced from P/ACE Setter Vol. 4, Issue 1, 2000.



## *Mass spectrometry integration.*

The P/ACE MDQ's external detector adapter allows simple interfacing with mass spectrometry.

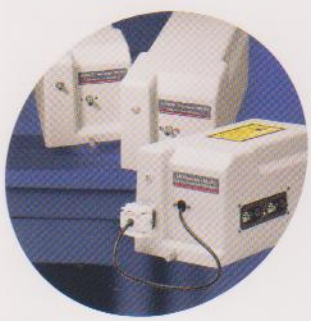


## *Sampling format.*

The system is compatible with 96-well plates, 2 ml vials, 0.5 ml vials, and PCR* vials. Sample containers may be stored in an optional temperature-controlled environment independent of the buffers.

## *Capillary cartridges.*

The capillaries are housed in user-assembled cartridges which are compatible with all current CE capillaries. Assembly of the cartridges is quick and easy. The cartridges integrate with the optical assembly, providing automatic alignment. Optical slits may be physically changed in seconds to optimize sensitivity and resolution.

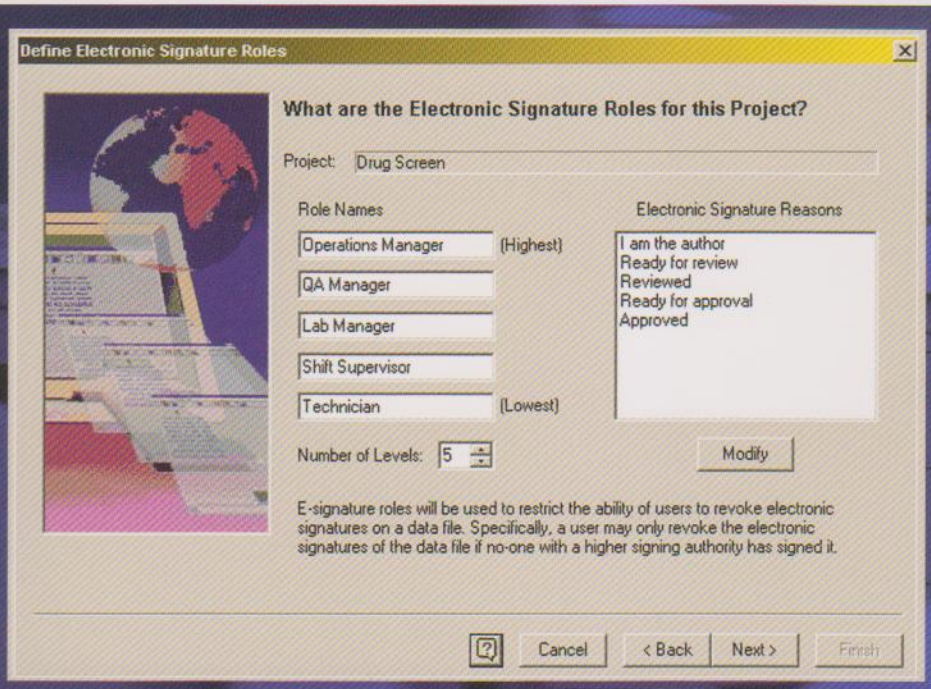


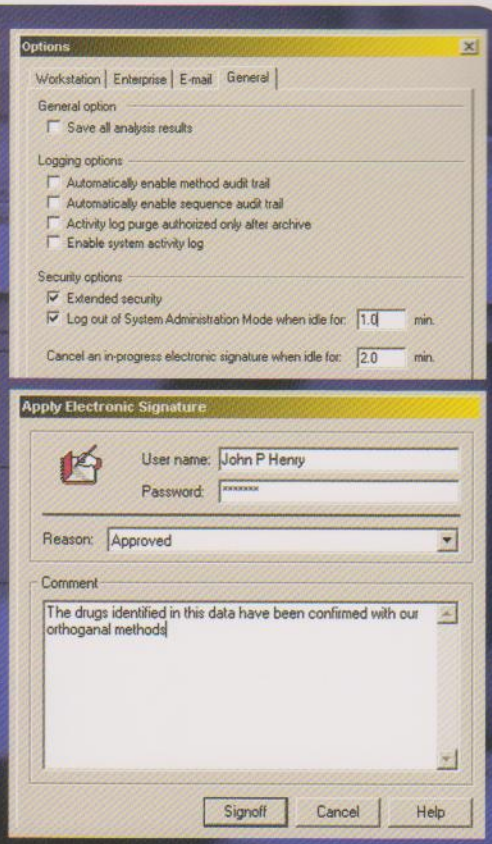
## *Detector modules.*

To allow for flexible methods development and rugged routine use, P/ACE MDQ's design makes it easy to interchange high-sensitivity diode array (DAD), UV/Vis, and laser-induced fluorescence (LIF) detection modules. An external detector adapter allows the capillary to be extended to additional detection systems.

## *32 Karat™ software, for advanced CE analysis.*

Working in conjunction with P/ACE MDQ hardware, our 32 Karat software helps further automate drug screening and affinity interaction processes. This software – unique to capillary electrophoresis – includes mobility plot generation, advanced reports, and new 2D algorithms to couple mobility and spectral signature for peak identification. All of which results in a fully integrated CE control and data analysis workstation.




## *Compliance support.*

32 Karat software contains the technical controls necessary to achieve compliance with Title 21 CFR Part 11, including system, method, data and sequence audit trails, permanent read-only method storage, and user-authentication routines with levels access for electronic signature signoff.

## *Control and analysis.*

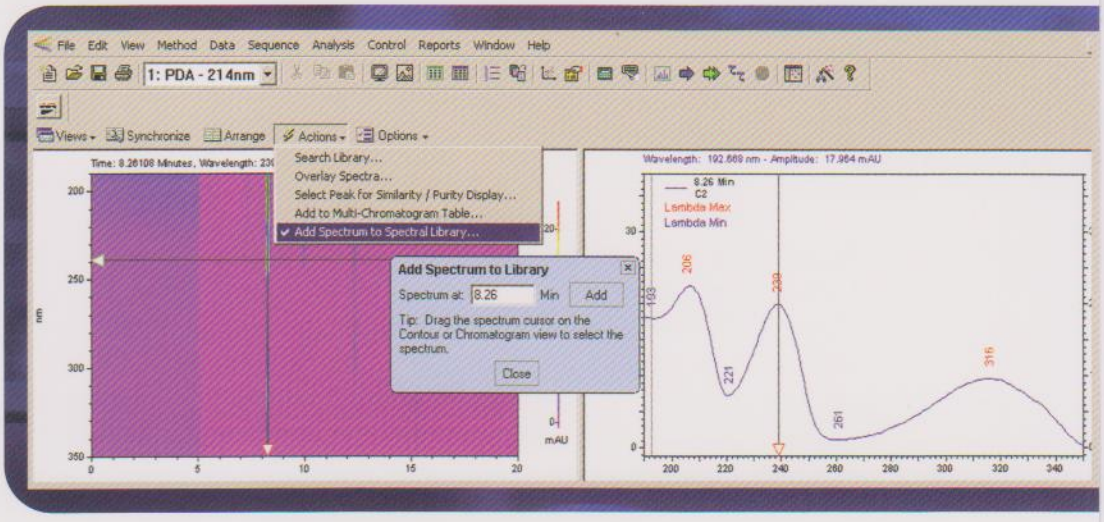
With true-to-life control, you get intuitive management of all system functions, and the ability to set run parameters in real time. Automated fractionation of a detected peak allows isolation of newly resolved compounds for external identification. Velocity-Calibrated Peak Area and CAESAR integration ensure reproducible quantitation at low limits of detection.

## *Methods development.*

Methods are defined and edited in table format. All functions for the system are handled in a single window, including programming of the buffer array for the automation of methods development strategies. All buffer information – including descriptions or preparation protocols – can be stored with the method. Multiple spectral libraries can be generated and searched automatically, using filters such as scan range, wavelength maximum, and mobility.

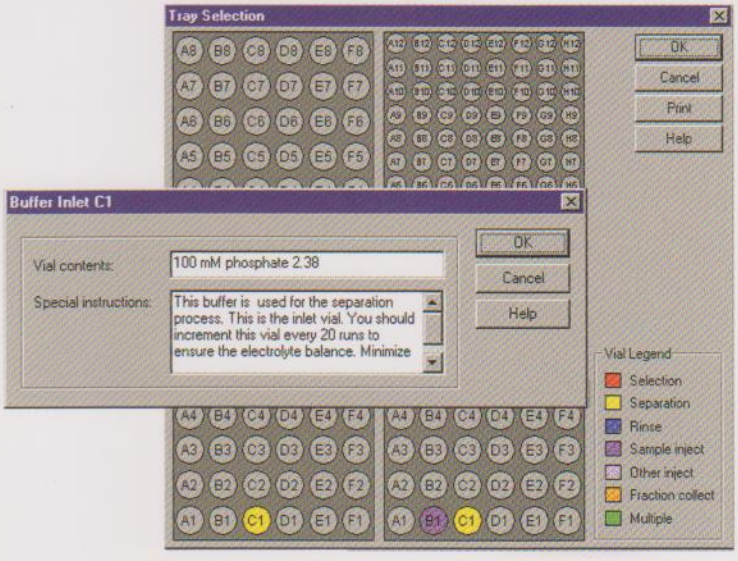
## *Array view.*

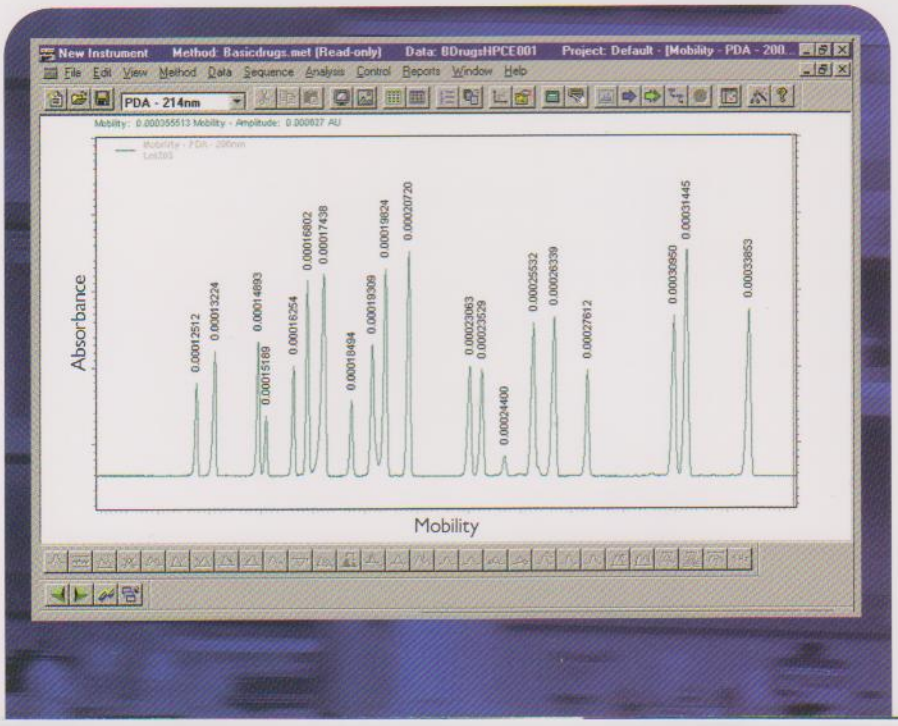
This easy-to-use graphical tool allows the user to access the abundance of data collected by the diode array detector. It lets you generate electropherograms at any wavelength, and scans derived from any peak–even during the run.




## *Buffer trays.*

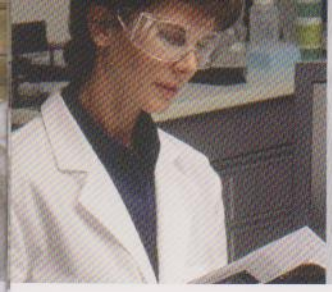
Buffer trays may be annotated with full descriptions – including buffer preparation protocols – which are all saved as part of the method.




## *Advanced peak identification.*

Our 2D Peak ID strategies combine migration time or mobility with spectral signature confirmation, allowing the ultimate identification of an analyte. In addition, data may be plotted by either migration time or mobility. Mobility plots allow you to assess physical molecular interactions and simplify interpretation by removing EOF variability.



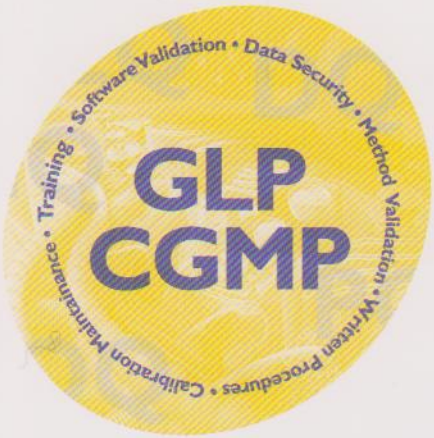
## *The process of support.*

Whether you have questions on the operation of your P/ACE MDQ, applications development or regulatory compliance, we offer a valuable and integrated assortment of product features, services, training and support. And our highly trained field service technicians are on call and on target in helping you get the most out of your Beckman Coulter products.


## *The inside story on better results.*

P/ACE Setter is a comprehensive worldwide newsletter for capillary electrophoresis technology. It provides a forum to share successful analytical strategies, while assisting you with the implementation of CE technology in your laboratory.

**For further information, visit us at www.beckmancoulter.com/cenews**




Because we know that training is a critical part of GMP, we provide a thorough, documented training process for new P/ACE MDQ operators. Documented maintenance and calibration as required by GLP/GMP is also available.

Installation Qualification (IQ) and Operation Qualification (OQ) documentation are available for your qualification of the P/ACE MDQ. The System Suitability features of 32 Karat software can be used as part of the Performance Qualification (PQ) process.

To give you the tools needed to achieve compliance with 21 CFR Part 11 – and perform validation assays in a regulated environment – 32 Karat software provides the ability to set different user accounts and permissions, track revision control, and enable electronic signatures. It also requires users to register any change to methods, and stores all versions of previous methods.

To help you always get the most out of your Beckman Coulter equipment, we maintain an excellent reputation for on-line, on-call and on-site support resources worldwide. And our experienced applications scientists are available to help you achieve optimum results.

## PRODUCT SPECIFICATIONS

### P/ACE™ MDQ Capillary Electrophoresis System

| | |
|---|---|
| Modes of Operation | Constant/Gradient Voltage†<br>Constant/Gradient Current†<br>Constant/Gradient Power†<br>Variable pressure |
| Sample Introduction | Pressure, Vacuum, Electrokinetic |
| Voltage Range | 1-30 kV (1-10 kV for injections),<br>Programmable in 0.1 kV increments<br>Reversible voltage programmed through user interface. |
| Current Range | 3-300 µ Amps |
| Pressure Range | -5 to +100 psig (Rinse/Separations)<br>-5 to +25 psig (Sample Introduction) |
| Sample Temperature Environment | 5° C to 60° C<br>(When ambient is defined as 25° C)<br>Sample temperature environment is independent of the ambient buffer environment. |

† Simultaneous pressure may be applied for these modes.

### System Capacity

| | | |
|---|---|---|
| Sample Tray | 2 x 96-well plates<br>2 x 48 2 mL vials<br>2 x 48 0.5 mL vials<br>2 x 48 PCR vials | |
| Buffer Tray | 2 x 36 2 mL vials<br>4 x 25 mL trays | |
| Capillary Cartridge Temperature | Recirculating liquid coolant 15° to 60° C<br>(When ambient is defined as 25° C) | |
| Wavelength Range | Diode Array 190-600 nm<br>UV/Vis 200, 214, 254, 280 nm standard filter<br>190-600 nm (with custom filter options) | |
| Detectors | Diode Array<br>UV/Vis<br>Laser-Induced Fluorescence | |
| Scan Collection | Diode Array 0.5-32 Hz (user selected) | |
| Data Rate Collection | 0.5 to 32 Hz | |
| Electrical | Voltage | 90-240 V 50/60 Hz |
| Dimensions | Height<br>Door Open<br>Width<br>Depth | 27.13 inches (68.90 cm)<br>36.5 inches (92.70 cm)<br>22.38 inches (56.83 cm)<br>24.13 inches (61.28 cm) |
| Weight (uncrated) | 132 lbs. (60 kg) without sample cooling option<br>155 lbs. (70.5 kg) with sample cooling option | |



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*Developing innovative solutions in Systems Biology.*

Innovate SIMPLIFY Automate

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B2003-5722-CB-20K



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