

Automation in a Forensic Laboratory

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Which processes can be automated in a forensic laboratory?

Nearly all steps in STR analysis from DNA extraction to PCR setup can be automated. Using the Biomek® 2000 Laboratory Automation Workstation, we have developed methods to automate isolation and quantitation of DNA, normalization of DNA concentrations and single amplification reaction setup. After automated PCR setup, you simply close the caps on the strip tubes and place them in the thermal cycler for amplification.

Which Promega chemistries can I use with automated liquid handlers?

Promega has automated DNA isolation using the DNA IQ™ System^(b) (Cat.# DC6700), DNA quantitation using the AluQuant® Human DNA Quantitation System^(h,i) (Cat. # DC1011) and PCR setup for the PowerPlex® 16 System^(c,e,f) (Cat.# DC6530).

Which automated liquid handlers have been used?

Promega scientists have integrated DNA extraction, quantitation, normalization and PCR setup on the Biomek® 2000 Laboratory Automation Workstation. This robotic platform

currently offers the most complete, automation solution for DNA isolation to STR amplification. We have also developed a database method for DNA extraction from buccal swabs using the DNA IQ™ System on the Tecan Genesis® RSP 150 instrument, and Perkin Elmer has developed a method for the MultiPROBE® II HT EX liquid-handling system.

Which sample types have been processed on the Biomek® 2000 workstation?

DNA has been isolated from both database and casework samples

using the DNA IQ™ System and the Biomek® 2000. Database samples that have been processed successfully include buccal swabs, blood punches (FTA® and S&S 903) and liquid blood. Casework samples include sperm and epithelial fractions from differential extractions, tissue samples, hairs and blood spots on blue jeans and underwear. A more extensive list of samples from which DNA has been isolated appears in the article “Application of the Biomek® 2000 Laboratory Automation Workstation and the DNA IQ™ System to the extraction of forensic casework samples” (1).

Table 1. Beckman Coulter Hardware Requirements for Automation of the DNA IQ™ System on the Biomek® 2000.

| Part Description | Beckman Coulter Part# | Number Required |
|-----------------------------------|-----------------------|----------------------------|
| Biomek® 2000 | 609000 | 1 |
| BioWorks™ 3.5 Software | 609983 | 1 |
| PC with Windows® XP OS | 987820 | 1 |
| LCD Display, Flat 15" | 978062 | 1 |
| Left Side Module | 987264 | 1 |
| MP200 Pipette Tool | 609025 | 1 |
| Gripper Tool Kit | 609735 | 1 |
| Black Tip Rack Holder | 609121 | 4* |
| Gray Labware Holder | 609120 | 6* |
| Thermal Exchange Unit | 148275 | 1 |
| DPC Shaker | 380560 | 1 |
| DPC Shaker Integration Kit | 380561 | 1 |
| Extra Serial Port for Shaker | 977092 | 1 |
| Modular Reservoir Frame | 372795 | 1 |
| Quarter Vertical Reservoir (18ml) | 372788 | 1 package of 48 |
| Quarter Single Reservoir (40ml) | 372790 | 1 package of 48 |
| P250 Sterile Barrier Tips | 140505 | As needed for # of samples |
| 2ml Square-Well Deep-Well Plates | 609681 | As needed for # of samples |

*Three Labware Holders and two Tip Rack Holders are included with part# 609000.

Note: Strip tubes (e.g., Continental Lab Products Cat.# 3426-85) and a MicroAmp® 96-well support base (Applied Biosystems Cat.# N801-0531) are also required.

TECH TIPS

How many samples can I process in a day?

If you extract, quantify, normalize and set up amplification reactions using one set of samples and one Biomek® 2000 workstation, you can process 80 samples in an 8-hour work day. Alternatively, if you decide to batch through samples (e.g., extract samples for an entire work day), it is feasible to process up to 352 samples (4 × 88 samples) per day on a single Biomek® 2000 instrument.

What hardware is required to automate the DNA IQ™ System, the AluQuant® System, the Biomek® 2000 Normalization Wizard, Genetic Identity Version, and the PCR Setup Method?

The hardware required from Beckman Coulter for automation of the DNA IQ™ System is listed in Table 1. The hardware required from Promega is shown in Table 2.

In addition to the hardware shown in Tables 1 and 2, the hardware listed in Tables 3 and 4 is required to automate DNA quantitation, normalization and assembly of PowerPlex® 16 reactions.

Table 2. Promega Hardware Requirements for Automation of the DNA IQ™ System on the Biomek® 2000.

Description

- Recirculating Water Bath
- Heat Transfer Block
- MagnaBot® 96 Magnetic Separation Device
- 1/4inch Foam Spacer
- Collection Plates

Please contact your local Promega representative for a quote on these items.

Table 3. Additional Beckman Coulter Hardware Requirements for Automation of the AluQuant® Human DNA Quantitation System, Normalization of DNA Concentrations and the PCR Setup Method.

| Part Description | Beckman Coulter Part # | Number Required |
|---|------------------------|----------------------------|
| MP20 Pipette Tool | 609024 | 1 |
| P200L Single Channel Tool | 609022 | 1 |
| P20 Single Channel Tool | 609021 | 1 |
| P20 Barrier Tips | 609043 | As needed for # of samples |
| P250 Non-Barrier Tips | 372654 | As needed for # of samples |
| 24-Position Tube Rack | 373661 | 1 |
| 11mm Diameter Insert | 373696 | 1 package |
| Full Reservoir | 372784 | 1 |
| LD400C Luminometer | 394100 | 1 |
| Extra Serial Port for LD400C Luminometer | 977092 | 1 |
| Beckman Coulter Biomek® 2000 Normalization Wizard, Genetic Identity Version | 969125 | 1 |

Note: 96-well, 1.1ml, square-well, V-bottom plates from Innovative Microplates (Cat.# S30026), strip tubes (e.g., Continental Lab Products Cat.# 3426.8S), unskirted PCR plates from Abgene (Cat.# 1055-00-0) and MicroAmp® 96-well support bases (Applied Biosystems Cat.# N801-0531) are also required.

I am concerned about contamination from sample to sample. How is this addressed?

The automated methods for DNA extraction, normalization and PCR setup on the Biomek® 2000 have been written and tested to minimize the potential for well-to-well contamination. Independent assessment of these methods has not shown any evidence of cross-contamination between wells of a 96-well plate by either “zebra stripe” (alternating columns of samples and blanks across a plate) or “checkerboard” studies of samples and blanks (1,2).

Whom do I contact if I am interested in automation in my laboratory?

Please contact your local Promega representative, who can provide a

quote for the necessary hardware and help arrange on-site training and installation of the Biomek® 2000 methods. Generally one day of training is required for the DNA IQ™ System and one day for the AluQuant® System, normalization and PCR setup. Extra days of training can be arranged if desired.

REFERENCES

1. Greenspoon, S.A. *et al.* (2004) Application of the Biomek® 2000 Laboratory Automation Workstation and the DNA IQ™ System to the extraction of forensic casework samples. *J. Forensic Sci.* **49**, 29–39.
2. Greenspoon, S.A. and Ban, J. (2002) Robotic extraction of mock sexual assault samples using the Biomek® 2000 and the DNA IQ™ System. *Profiles in DNA* **5**(1), 3–5.

Table 4. Promega Hardware Requirements for Automation of the AluQuant® Human DNA Quantitation System, Normalization of DNA Concentrations and the PCR Setup Method.

| Description |
|-----------------------------------|
| AluQuant® Calculator ¹ |
| Strip Tube Holders |
| Dry Block Heaters |
| Heat Block Inserts |
| Plate Clamps 96 ⁽ⁱ⁾ |
| Luminometer Plates |

¹Requires Microsoft® Excel

Please contact your local Promega representative for a quote on these items.