Instrumentation

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CONTENTS

I. Nucleic Acid Extraction and Purification .................................. 13-2
   COBAS® Ampliprep ........................................... 13-2
   MagNA Pure® LC Instrument (Roche Diagnostics) .................. 13-2
   MagNA Pure Compact Instrument (Roche Diagnostics) .......... 13-3
   AUTOPURE LS (Qiagen/Gentra Systems; Netherlands) ............ 13-3
   BioRobot M96 (Qiagen) ...................................... 13-5

II. Spectrophotometers ............................................. 13-5
    NanoDrop® ND-1000 ........................................ 13-5

III. Thermocyclers for Conventional PCR ................................. 13-6
    GeneAmp® PCR System 9600 .................................. 13-6
    GeneAmp PCR System 9700 (Applied Biosystems, Foster City, CA) ........................................ 13-7
    COBAS AMPLICOR® Analyzer (Roche Diagnostics) ............ 13-7

IV. Real-Time PCR Instruments ..................................... 13-9
    COBAS TaqMan 48 Analyzer (Roche Diagnostics) ................ 13-9
    LightCycler ..................................................... 13-11
    LightCycler 2.0 (Roche Applied Science) .......................... 13-15
    GeneXpert® Dx System ....................................... 13-15

V. DNA Microarray Platforms ................................ 13-17
    GeneChip® System 3000Dx ..................................... 13-17
    NanoChip® 400 .................................................. 13-19

VI. xMAP® Technology .......................................... 13-21
    Luminex® 100 IS System and Luminex 200 System (Luminex Corporation) ........................................ 13-21

VII. Capillary Electrophoresis .................................... 13-23
     Applied Biosystems 3730 and 3730 XL ........................ 13-23

VIII. Gel Imaging Systems ....................................... 13-24
      Bio-Rad Gel Doc™ EQ, ChemiDoc™ EQ, and ChemiDoc™ XRS ........................................ 13-24

IX. Luminometers .................................................. 13-26
    Digene Microplate Luminometer (DML2000) ....................... 13-26

X. Fluorescence Microscope .................................... 13-27

XI. Suggested Reading ............................................. 13-28
The following is a brief overview of representative instruments and categories of instruments central to the practice of molecular diagnostics and related fields. Some of these instruments have been introduced in other chapters. While a comprehensive survey of all such equipment is beyond the scope of this book, more extensive information is readily available from manufacturers’ websites and brochures.

**NUCLEIC ACID EXTRACTION AND PURIFICATION**

**COBAS® Ampliprep**
- **General information:**
  - The COBAS ampliprep (Roche Diagnostics, Basel, Switzerland) instrument (Figure 1) uses solution-phase magnetic bead capture in the automated extraction of nucleic acids
  - It is appropriate for large-scale preparation of DNA and RNA samples
- **Principles of operation:**
  - Processing of each sample takes place in a separate, self-contained, single-use, disposable sample processing unit
  - Sample volume can range from 250–1000 µL
  - All stages of nucleic acid separation are automated, including: decapping, pipeting, lysis, magnetic bead capture, washing/purification of captured nucleic acid, and resuspension/release of purified nucleic acid from beads
- **Procedure:**
  - Startup procedures are performed
  - Reagents are loaded onto instrument
  - Samples are removed from storage
  - Consumables are loaded onto instrument
  - Orders are created
  - Samples are transferred to sample tubes (input S-tubes), which are held in a sample rack
  - Sample racks are loaded onto instrument
  - Run is initiated
  - After completion of run, processed samples and used consumables are removed
- **Applications:**
  - High-throughput extraction and purification of nucleic acids
- **Advantages:**
  - High throughput
    - Capable of continuous operation
    - 72 sample capacity
    - First 24 samples are processed in 2 hours
    - Each subsequent set of 24 samples can be processed in 1 hour
    - Can process up to 144 samples per 8 hour shift
    - Samples can be run overnight (20 hour on-board stability)
  - Can automatically add polymerase chain reaction (PCR) master mix and internal control/quantitation standard (IC/QS)
  - Manual steps are minimized (loading and unloading only)
  - Machine has automated decapper, thus capped specimens may be loaded, decreasing risk of contamination
  - Reagents are loaded as a unit (no mixing of lots, increased reproducibility)
  - Continuous access for loading additional samples, reagents, and disposables
  - On board bar code scanner reads reagent and sample barcodes, eliminating transcription errors
  - Pipeting error is minimized by pipeting integrity check and clot detection
  - Instrument can directly load K-tubes for analysis on COBAS TaqMan® analyzers
  - Instrument inventories reagents and disposables prior to run
- **Limitations:**
  - Only for use with plasma or serum samples
  - Limited to total nucleic acid extraction

**MagNA Pure® LC Instrument (Roche Diagnostics)**
- **General information:**
  - The MagNA Pure LC instrument (Figure 2) is an automated system for purification of nucleic acids following prior cell lysis.