Densitometers, laboratory, scanning

Health problem addressed
Scanning densitometers can be used to diagnose multiple sclerosis, fetal lung immaturity, and for the detection of certain types and levels of hemoglobin. Hemoglobin electrophoresis is used to screen for sickle cell anemia, among other hemoglobin pathologies.

Product description
The basic components of traditional scanning densitometers are a light source, a monochromator, devices to provide sample motion or analysis over a given area, optical systems to direct and regulate light waves, and a photodetector. Because very few light sources optimally produce all the wavelengths necessary for clinical use, two or more light sources must often be used.

Principles of operation
Before densitometric analysis begins, the sample and support media may need preparation to differentiate and visualize the sample. Fluorescence measurements require an ultraviolet light source, such as a deuterium filament, which produces light at wavelengths from 200 to 600 nanometers (nm) and falls within the ultraviolet range (4 to 400 nm). Absorbance measurements require light transmission in the visible spectrum (390 to 770 nm); a light source such as a tungsten filament, producing wavelengths from 360 to 800 nm, falls within this range. The light is sent through a monochromator, which takes polychromatic light (light of multiple wavelengths) and eliminates all but one wavelength. As the monochromatic light leaves the monochromator, it passes through a slit of a predetermined size to restrict the amount of light transferred to the sample area. Depending on instrument capabilities and the test procedure selected, the sample either absorbs the light or fluoresces. A series of mathematical calculations and standard readings creates a signal indicating the precise optical density of the sample, which is sent through an amplifier to an output device to be displayed and/or printed out.

Operating steps
- Operator prepares sample and support media.
- Operator inserts sample into densitometer.
- Operator reads optical density of sample displayed on computer screen or on printed report.

Reported problems
Most reported problems result from interference or inconsistencies during electrophoresis or staining procedures. Even in the absence of ultraviolet light, autofluorescence and interference are caused by naturally fluorescing materials, such as albumin from patients with end-stage renal disease. Nonuniform staining of the sample causes other problems.

Use and maintenance
User(s): Laboratory technicians
Maintenance: Biomedical engineering staff and/or service contract with the manufacturer or third-party organization
Training: Training by manufacturer and manuals

Environment of use
Settings of use: Clinical laboratory
Requirements: Stable power source

Product specifications
- Approx. dimensions (mm): 620 x 620 x 351
- Approx. weight (kg): 38
- Consumables: Replacement lamps; color- or fluorescence-producing reagents; cleaning solvents
- Price range (USD): 1,200-37,000 (10,000 typical); price covers all types and variations
- Typical product life time: 8 years
- Shelf life (consumables): NA

Types and variations
- Video densitometers
- Non-video densitometers
- Densitometers with electrophoresis capabilities
- Densitometers without electrophoresis capabilities