DNA: Contamination Control

Introduction

DNA laboratories require special laboratory configuration and sample handling protocols.

QAS 7.1.3

Because of the sensitivity of PCR-based procedures, special precautions must be taken to avoid contamination of samples to be amplified.

Descriptions of control measures for the following potential sources of sample contamination follow:

- environmental DNA
- cross-contamination
- PCR product carry-over

Environmental DNA

Precautions should be taken to minimize the potential of contamination by environmental human genomic DNA. Analysts should:

- wear gloves at all times when handling evidence or reference samples
- close sample tubes when not in use
- keep aerosol dispersion to a minimum

Cross-contamination

Precautions should be taken during evidence examination and all steps of DNA analysis to prevent transfer of DNA from one sample to another.

- Analysts must use a fresh pipette tip for each sample, open tubes carefully, and keep sample containers closed when not in use.
- Samples expected to have low concentration of DNA, such as single hairs, should be extracted at a different time or space from those of expected higher concentration.
- Evidence and reference samples must be extracted separately in time or space.
- Primary evidence collected directly from the body of a victim and from a suspect within the same case must be sampled and extracted separately in time or space.
- A pipettor and barrier tips should be used in setting up PCR reactions for aliquoting PCR pre-mix.
- Barrier pipette tips should be used.

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Amplified DNA

QAS 6.1.3a

Amplified DNA must be contained to prevent it from ever coming in contact with samples that have not yet been amplified. To minimize the potential for contamination from amplified DNA, the DNA Laboratory is organized so that the area in which amplified DNA is handled is physically isolated from the extraction and set up areas. The doors separating the Amplification/typing room from the rest of the Biology laboratory are closed at all times except for passage. See *DNA laboratory work areas* below.

Capillary electrophoresis carryover

During capillary electrophoresis, an amplified sample may be detected in another amplified sample or a formamide blank. This may occur when:

- A capillary containing a sample with a high concentration of amplified DNA is insufficiently flushed or rinsed between injections.
- An analyst touches a pipette tip containing amplified DNA to a different well.
- Aerosols from an amplified sample are introduced into a different well.

Capillary electrophoresis carryover may occur between samples run on the same plate or less frequently between samples in different runs. Carryover typically occurs at a low level or at a level that does not reach the laboratory's analytical threshold. If carryover occurs between casework samples and is above the detection threshold, the affected samples should be re-prepared and rerun. If the carryover result is reproducible, additional troubleshooting must be done to determine the source of contamination. If the result is not reproducible, the sample where carryover was detected is not contaminated. If carryover occurs between a casework sample and a formamide blank or if possible carryover is below the analytical threshold, it should be noted in the examination records.

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DNA laboratory work areas

QAS 6.1.2

The DNA laboratory has four designated work areas.

- **Evidence examination areas:** These areas are used for the examination of evidence items and for the screening, identification, and collection of biological stains.
- **DNA extraction areas:** These areas (lab benches, chemical hoods, the vacufuge room, and the robot room) are used for extraction and isolation of DNA, including sample digestion, extraction, and concentration.
  - Extraction of samples expected to contain low DNA levels are separated in time or space from other DNA extractions. Additionally, the extraction of reference samples are separated in time or space from the extraction of evidence samples.
- **Quantitation/PCR set-up room:** This room is used to prepare extracted DNA for quantitation/amplification.
  - Dedicated equipment and supplies located in this area are for quantitation/PCR set up only.
- **Amplification/typing room:** This room is used only for those activities that involve the handling of amplified DNA. This includes quantitation (based on Real Time PCR methodology), capillary electrophoresis of amplified DNA, waste disposal of amplified DNA products, and storage of amplified DNA.
  - Dedicated equipment and supplies located in this room are for use with amplified DNA only.

Additional precautions

The types of contamination described above are concerns during sample preparation and PCR set up. The contamination of amplified DNA with unamplified DNA does not pose a problem. However, ordinary precautions, such as changing pipette tips between samples, should be taken to prevent cross-contamination between samples of amplified DNA.

Documentation

Refer to *DNA: Elimination Samples* for the documentation of observed instances of contamination.