

From: [Heidi Baker](#)
To: [Susan Hedge](#)
Subject: Sampling techniques and reporting DNA by QPS
Date: Tuesday, 1 November 2022 6:26:13 AM
Attachments: [image002.png](#)

Dear Susan

Thankyou for considering the matters raised in our e-mail. We have prepared the following e-mail, tailored for disclosure, and hereby provide permission for you to pass this e-mail onto the parties.

Sampling technique

We understand from the Krosch paper that QPS is using rayon swabs. QPS SOP 'Collection of Biological Evidence' describes the use of 70% ethanol applied to swabs as a wetting agent in the collection of biological material including blood. This is not something we have seen before (cotton + water is what we are familiar with), so we have looked to the literature to see what we could find in relation to rayon swab + ethanol.

We note the following:

- A decision of what sampling devices to use to collect DNA from forensic items is a complex one. Consideration must be given to body fluid, surface type (including roughness and substrate material), swab material, ease of use (i.e. bendiness of stick/ability to snap off/presence of desiccant), wetting agent, interaction with extraction chemistries or tubes, cost, availability and ability for crime scene officers to use the 'correct' swab in the correct circumstances.
- Available research shows that no one swab is perfect in all circumstances. Forensic Science Providers must therefore make decisions based on all the factors to select a swab(s) that performs optimally in the largest number of cases. From a review of the literature, a very wide variety of swabs/wetting agents/mechanisms are in use. A review from Bonsu et al notes that "there is currently no consistency in swabbing devices used in different forensic laboratories".
- When taking a systems approach, it is necessary to consider the impact of *all* parts of the system on all others. This is particularly important when it comes to DNA collection – as the first part of the process, any failure here will guarantee failure downstream. Optimisation of collection, and knowledge of how the collection may impact on the analysis and interpretation of DNA results, is important. We do note however that there is limited published data on this – whether laboratories are doing these checks and not publishing/sharing the information, or not doing the checks, is unknown.
- Data available on swab selection and wetting agent is limited, and at times contradictory. The table below summarises the findings, but in general: ethanol appears to be detrimental to *some* body fluids, but it has very limited empirical evidence to support or refute its use. Rayon swabs appear to collect less DNA, and release less DNA during extraction, than other swabs (including cotton and nylon flocked).

In summary, without empirical evidence demonstrating the validity of the combination of rayon and ethanol for collection, it is difficult to make a judgement on the appropriateness (or otherwise) of the current QPS methodology. However, based on the available literature, we

would recommended that investigations are performed to confirm suitability. This is particularly in light of the new types of self-drying or self-vented swabs that may be beneficial in the Queensland environment, reducing the need for ethanol as a drying agent.

Paper	Findings
Bonsu et al. 2020. Evaluation of the efficiency of Isohelix and Rayon swabs for recovery of DNA from metal surfaces. For Sci Med Pathol.	<p>Isohelix + IPA outperformed Rayon+ water. 42% of collected DNA was retained by the rayon swab (ie not extracted from swab)</p> <p>Rayon swabs recovered:</p> <ul style="list-style-type: none"> • 50% of DNA from plastic • 11-29% of DNA from metal • 11% from copper
Janssen et al (2019). Biological stain collection – absorbing paper is superior to cotton swabs. For Sci Int Genet Supp Ser 7:468-469	Swabbing blood on glass slides with either water or ethanol showed no difference (0.68 ng/ul with water cf 0.63ng/ul with ethanol)
Lacerenza et al. (2022) Evaluation of the effects of different sample collection strategies on DNA/RNA co-analysis of forensic stains. Genes 13:983	<p>Ethanol recovery of DNA compared to water</p> <ul style="list-style-type: none"> • Reduced blood recovery by 28-fold (from 4.727ng/ul to 0.166ng/ul) • Reduced luminol treated blood by 1.4-fold (from 0.117ng/ul to 0.084ng/ul) • Reduced saliva by 1.4-fold (0.328 to 0.230) • Reduced semen by 2.5-fold (23.02 to 9.114) • Increased skin by 5 fold (0.038 with ethanol to 0.007 with water)
Bruijns et al (2018). The extraction and recovery efficiency of pure DNA for different types of swabs. J Forensic Sciences 63:1492-1499	<p>Rayon swabs:</p> <ul style="list-style-type: none"> • Had very reduced extraction efficiency compared to other swab types (e.g. cotton swabs - ~25%, Rayon ~18%, Nylon Flocked swabs 50%) • Had reduced recovery efficiency (i.e. ability to collect from surfaces) e.g. cotton swabs ~35%, rayon 20-25%, nylon flocked 45%)
Verdon et al. Swabs as DNA collection devices for sampling different biological materials from different substrates. J For Sci 59: 1080-1089.	<p>Rayon swabs:</p> <ul style="list-style-type: none"> • Collected less DNA from neat blood • Collected similar amounts (slightly less, slightly more) from diluted blood, neat and diluted saliva • Collected less touch DNA (fewer alleles detected and less complete profiles)
Frippiat & Noel. (2016) Comparison of performance of genetics 4N6 FLOQSwabs with or without surfactant to rayon swabs. J For Legal Med 42:96-	<p>Rayon swabs:</p> <ul style="list-style-type: none"> • Recovered less DNA from blood at low amounts (0.1-2ul), but more DNA from higher amounts (5ul) compared to flocked

Reporting DNA

We note from the SOPs that QPS forensic officers are reporting simple DNA results in their statements.

- 9.0.1 Forensics officers are required to report simple positive or negative DNA analysis results received from QHFSS for exhibits that they collected. Forensic officers are not to report results for cases that involve mixed or partial DNA profiles. They also should not report in cases where profiles were obtained as a result of sample rework/reinterpretation. In these instances, a biologist from QHFSS will need to be called to give all of the evidence.
- 9.0.2 Forensic officers who are authorised to perform 'Bloodstain Pattern Analysis' may be required to rely on evidence of a DNA profile/s to assist with their interpretation and, in such circumstance, may include the DNA profile information in their statement. Reference to electronic records of QHFSS results on the Forensic Register is permissible, however the use of results in a statement released by the QHFSS case officer is preferred. The Bloodstain Pattern Analyst statement should indicate that DNA results need to be verified and/or qualified by the QHFSS case officer.

It may be that QPS Forensic Officers are DNA experts and have a full understanding of QHFSS protocols. If not, presumably they are reporting evidence of fact, not opinion, and their statements convey this clearly. Given the complexities of DNA evidence as highlighted by the Commission, we feel this is of vital importance.

We trust this information is of assistance and are highlighting to ensure that the front end processing is best supporting the downstream DNA processing in the lab, and the reporting of DNA evidence in statements and by provision of expert evidence at court.

Noho ora mai

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