**Commentary**

## Skin Biology for the Forensic Scientist

This is a brief commentary on a recently published article with a surprising finding that indicates recent touch DNA from a handler is more detectable than the wearer of the item (Sessa, F, Salerno, M, Bertozzi, G, Messina, G, Ricci, P, Ledda, C et al. Touch DNA: impact of handling time on touch deposit and evaluation of different recovery techniques: An experimental study. Scientific Reports 2019; 9: 9542.). Touch DNA has been studied since 1997 and more than twenty years later, the ability to predict the timing of DNA deposit has remained elusive and variable. The Sessa et al. article is an interesting scientific study that suggests recent touch could be the more predominant and successfully genotyped profile.

An improved understanding of basic cellular processes like cell division and organ development enhance our understanding of the types of biological evidence left behind at a crime scene. Invisible or barely visible traces such as touch DNA samples, saliva stains, vaginal fluids and latent prints all share a common element, the epithelial cell. The developmental processes behind epithelial cell initiation, maturation and apoptosis are amazingly well regulated cellular processes underlying the development of the largest human organ, commonly known as the skin.

In 1956, turnover rates were studied in the skin epidermis and intestinal epithelium by Hooper (1). Mobile cell populations in blood samples were identified as having a rapid turnover rate compared to most fixed tissues except the skin epidermis. The epidermis is characterized by stratified tightly adherent cells arranged in layers where mitosis is restricted to the lower layers. In order to maintain the correct thickness of the skin, the number of dividing cells must equal the number of senescing cells and must move from the origin that is deeper in the epidermis as a coordinated tissue unit to the surface. India ink injection studies confirmed this theory; the cell layers of the epidermis are displaced together and differentiate together as a coordinated event. Studies of cell turnover included an estimated turnover rate of thirteen days for cells on the forearm. Environmental factors may affect the turnover rate and include calorie load, nutrition, hormones and temperature. Overall, the epidermis is a coordinated cell renewal system designed to protect an individual and eliminate cells that become damaged or infected on a regular basis.

DNA from fingerprints was first reported in Nature by van Oorschot et al. in 1997 (2). Since then, the pursuit of the characterization of how DNA is deposited and transferred has been consistently studied but remains elusive. The relevance to forensic science education is obvious from a recent *Scientific Reports* article that describes the unusual finding of simulated handler contact with clothing being more successful in yielding DNA results than the recovery of the wearer DNA from the clothing (3). How is it that this scientific finding could be inverted from our expectation based on length of contact?

Of the total 240 samples obtained from the brassiere that had been sterilized and then worn for more than 12 hours, surprisingly only 5 samples were detected as the wearer having the major profile. The full DNA profile from the handler processed for touch DNA was detected at a high rate (87.6% to 99.24%). This finding was regardless of handler time or DNA collection method. One excellent explanation for better detection of the most recent but likely less abundant handler DNA in this study is the effect on cellular and free DNA and exposure to the environment. The environment contains moisture which facilitates bacterial action. Bacteria and human skin contain enzymes called DNases that are protective and designed to break down foreign DNA on the skin surface that could be infective. A DNase enzyme catalyzes the hydrolysis of phosphodiester linkages in the DNA molecule resulting in a degradation of the double helix to single nucleotides. Single nucleotides are not detectable with standard human identification test methods [e.g. short tandem repeat (STR) analysis]. This could be one scientific explanation for the observation of less wearer DNA in this particular study. It would be highly interesting to place a "clock" on the DNA degradation mechanism by DNases to explain the high level of variability of DNA recovery from different handled items that have been published in a variety of scientific studies; an interesting future direction of inquiry on touch DNA (4, 5).

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**References**

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