D4 Latent Fingerprint Detection on Dry Human Bones Using Ninhydrin, Cyanoacrylate-Fuming, and Rhodamine-6-G Methods

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The goal of this presentation is to determine the visibility of latent fingerprints on dry human bones with the intent of aiding law enforcement officials in determining culpability of homicide.

Previous studies have determined that Ninhydrin is an effective reagent in visualizing fingerprints on porous surfaces such as paper, cardboard, raw wood, and wall coverings. The Cyanoacrylate-Fuming method uses Cyanoacrylate fumes combined with humidity to develop latent fingerprints on non-porous surfaces and some porous surfaces. Both the Ninhydrin and the Cyanoacrylate-Fuming (Superglue™) techniques were used to determine which, if not both, were the most effective in visualizing latent fingerprints.

This study incorporated human femora, human pelvic bones, and deer femora from the FACES Laboratory at Louisiana State University. Cases from as early as 1983, and as recently as 2001, were used to differentiate time parameters in determining the length of time fingerprints persist on porous surfaces. Cleaned, processed bones were used as well as bones that had been housed immediately following recovery. These variables were used in order to determine the conditions necessary to reach the optimum visibility on these bones.

Ninhydrin involves a chemical reaction using a Ninhydrin crystal- based reagent to stain a porous surface when reacting with amino acids in the fingerprint. The resulting stain is called "Ruhemann's Purple" after the English chemist that first developed Ninhydrin in the early 1900s. The solution can be applied by painting, dipping, pouring, or spraying and is reapplied in the same manner twenty-four hours later. Heat and humidity are then applied to accelerate the development of prints. It is necessary to monitor the progress of the fingerprints as the process advances in order to record any visible prints that may appear and then disappear quickly.

The Cyanoacrylate-Fuming method produces more rapid results using an environmental Cyanoacrylate-fuming chamber. This allows the researcher to control the amount of humidity that is necessary for the adherence of fumes to the fingerprints. The Cyanoacrylate ester (Superglue™) packet is opened and sealed in the chamber with the bones and open containers of steaming water. This humidity facilitates development of latent prints that are present. The fumes produce a white deposit that adheres to the protein compounds in the fingerprints. The bones are then processed with Rhodamine-6-G, which is a fluorescent dye that is used to stain the fingerprints. When using these methods, it is important to perform either the Ninhydrin test or the Cyanoacrylate- Fuming method, since these methods do interfere with one another.

Initial testing showed that the deer femur developed latent fingerprints within thirty minutes using the Ninhydrin method but the prints disappeared within two hours. The Cyanoacrylate-Fuming method did not produce any results on the deer femur.

The human bones did not produce any visible fingerprints using the Cyanoacrylate-Fuming method initially. In order to determine the viability of the Ninhydrin test, lotion, which reacts with Ninhydrin, was applied to the hands of the researcher before the bones were handled again and the Ninhydrin was re-applied. The human bones produced visible prints using the Ninhydrin method after applying lotion to the hands.

Further testing showed that the human bones developed latent prints using the Cyanoacrylate-Fuming method with recent handling of these bones, but the prints only showed up after they were treated with Rhodamine-6-G. Fingerprints were not developed on the human bones with the Ninhydrin method; however, the deer femur did develop latent fingerprints using the Ninhydrin method, and the prints showed up within one hour of applying the solution. The prints did not absorb into the background after two hours as in the original test. However, the deer femur only produced results with the Ninhydrin and not the Cyanoacrylate-Fuming method.

Both the Ninhydrin and Cyanoacrylate-Fuming methods have been tested on human and deer bone in an attempt to show the presence of latent fingerprints. The Ninhydrin test proved to be most effective on the deer femora and the Cyanoacrylate-Fuming method proved to be the most effective on the human bone after treating with Rhodamine-6-G.

The delineation between the processes and their effectiveness could be due to the differences in osteon alignment in human and non-human bone or the compactness therein. Studies in osteon alignment in human and non-human bone have suggested that the non-human bones have more of a regulated alignment than do human bones. This could affect the porosity of the bone and allow fingerprints to be absorbed into bone at a more rapid pace in human bone than in non-human. The Ninhydrin method might have better results with the non-human bones, due to the compactness of the cortical bone versus the porosity of human bone. The Cyanoacrylate-Fuming method might work better on more porous surfaces such as human bone.

To be able to visualize latent fingerprints on human and non-human bone may not only impact homicide cases but may also be an effective tool in Wildlife and Fisheries departments across the country. The

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research shows that latent fingerprints can be visible on dry human bones as well as non-human bones. The next step in this research is to determine how long the fingerprints will remain on bone in various climates.

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