FIRST RESPONDERS
TIME TO GIVE UP YOUR DNA

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The Command College Futures Study Project is a FUTURES study of a particular emerging issue of relevance to law enforcement. Its purpose is NOT to predict the future; rather, to project a variety of possible scenarios useful for strategic planning in anticipation of the emerging landscape facing policing organizations.

This journal article was created using the futures forecasting process of Command College and its outcomes. Defining the future differs from analyzing the past, because it has not yet happened. In this article, methodologies have been used to discern useful alternatives to enhance the success of planners and leaders in their response to a range of possible future environments.

Managing the future means influencing it—creating, constraining and adapting to emerging trends and events in a way that optimizes the opportunities and minimizes the threats of relevance to the profession.

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FIRST RESPONDERS

TIME TO GIVE UP YOUR DNA

It was a typical beautiful day in small town USA in the year 2019. A police detective receives a text from dispatch to respond to a dead body call. By the time he arrived on scene, patrol officers had already been conducting a house-to-house check for witnesses and had uncovered some interesting results.

A few houses down from the victim’s residence, a patrol officer made contact with a small time drug dealer who lived there. The subject seemed nervous while talking with the police, and changed his story of knowing the victim initially; later recanting. While talking with the officer, the dealer discarded a cigarette and threw it onto the ground. The officer leaned down and immediately recovered the cigarette, placing it into an evidence envelope. A few minutes later, the patrol cop handed the envelope to the detective. Using his newly acquired personal digital assistant (PDA) with “DNA Lab on a Chip” technology, the detective processed the cigarette and had a DNA profile of the drug dealer in less than 30 minutes.

Detectives talked with the drug dealer at the suggestion of patrol personnel; within minutes, they concluded the subject was avoiding the truth, and that he knew more than he was telling them. DNA recovered from the cigarette was subsequently uploaded to the Crime Laboratory’s local server. It verified the drug dealer was, in fact, arrested before, and the DNA from the cigarette matched his DNA on file with the FBI. A short time later, the detective received a text from the FBI DOJ CODIS Unit, where he learned the DNA from the drug dealer matched the DNA recovered by the Crime Lab from blood drops recovered from the victim’s residence. The drug dealer was escorted to the police station for further questioning.
Does this story sound too good to be true? It may be…but maybe not. The use of on-scene DNA identification and similar technologies will become increasingly available to solve crimes in the next decade. It will become vital to understand, identify and maximize their use to ensure they are deployed in a manner that supports the investigation of the future.

**First Responders could leave their DNA at your crime scene**

In a perfect world there would be no contamination issues at crime scenes. But we're not in a perfect world, are we? We have set standards of response to crimes scenes; we have safety issues with which to contend. In practice, though, we have police officers, fire fighters, paramedics and EMT’s strolling through the scene. Of course, the Captain or Chief are also often there. Anyone on scene could leave their DNA behind (*Advancing Justice*, n.d.).

Police personnel may have received a limited amount of training about retaining the integrity of crime scenes, but fire and EMS are not trained in the same fashion according to Captain Michael Miller, of the Pleasanton & Livermore Fire Department (Miller, 2010). According to Miller, a limited amount of training is given to fire fighters on the integrity of crime scene evidence. Both fire and EMS need to evaluate their training needs to meet the same standards. An important part of training for all first responders should be the sources and goals of DNA collection. These are:

- blood (liquid or dry)
- skin cells
- sperm cells
- hair roots and saliva (saliva samples obtained through buccal swabs)
- capabilities of DNA evidence
• goals of biological evidence collections

• recommendation for collecting DNA from liquid and dry blood stains; and,

• standards - how to minimize human contamination, ways to avoid cross contamination, collection of reference samples of living subjects, packaging of DNA evidence, factors leading to DNA degradation and blood evidence storage procedures

These standards are set by the Federal Bureau of Investigation (FBI) Quality assurance standards for DNA databasing laboratories. As a first step to maximize the use of DNA collection technologies, we must train police, fire and EMS agencies to do a better job to ensure we limit those that come into crime scenes and train personnel about the hazards of contaminations at crime scenes (Federal Bureau of Investigation, Quality Assurance Standards, 2000).

Training will only further enhance the accuracy of obtaining DNA evidence (“Contamination Issues”, 2001). Once we have improved our capability to reduce contamination, we will have the opportunity to put emerging technology to good use. One in particular offers great promise to quickly identify DNA evidence and match it to those sought for the commission of crimes.

DNA Lab on a Chip Technology

DNA on a Chip is already here. This new technology will have wide ranging impacts to law enforcement throughout the nation in the very near future. Researchers at the University of Michigan, headed by Dr. Mark A. Burns, recently announced a breakthrough in DNA testing that would save an immense amount of time and money (Saran, n.d.). They developed a “DNA lab in a chip”, that will make it easier for DNA-testing tasks. The research, financed with $3 million in
grants from the National Institute of Health, was conducted by a team of engineering and genetic scientists for more than five years.

The chip automatically analyzes DNA samples and reports the results electronically. It includes systems for:

- metering, measuring, mixing microscopic liquid samples of DNA with reagents
- moving the mixtures to a temperature-controlled area, separating DNA molecules by size through gel electrophoresis; and,
- determining the results with an on-board fluorescent detector

All parts of this procedure are placed on a glass-and-silicon wafer, aside from external light and air-pressure sources.

Unlike conventional testing, instruments using the chip do not require intervention by laboratory personnel or robots during the procedure (Saran, n.d.). Using the chip will not only lessen the time and cost of conducting DNA tests, but less biological evidence will be required in the process. As the wireless WIFI technology continues to advance, the uploading capabilities directly to a database from a crime scene could be just around the coroner according to Saran (n.d.). The possibilities are endless.

Mass production for use by law enforcement throughout the world is still in the formative stage, and associated costs will still need to be determined. According to Dr. Mark Burns, lead researcher in the chip’s development, it is smaller than a child's little finger, and would cost less than $6 to manufacture (Saran, n.d). Wholesale production of the chip can further reduce cost significantly. The portability and cost-effectiveness of this chip will make it particularly useful for the first responder at crime scenes because DNA and other biological evidence can be processed quickly to avoid any contamination issues. In contrast to current
DNA analysis in a standard laboratory—which relies on human intervention at several stages to manipulate or observe samples and record results—the self-contained "lab on a chip" represents an almost "hands free" technology. The research success with the DNA-testing chip suggests that similar integrated systems can be constructed at the nanoliter scale using sample and reagent volumes far smaller than those needed in typical human or robotic handling methods.

The potential benefits to the prosecution and defense of DNA related cases is enormous. Turnaround times for DNA processing will become a thing of the past. Suspects will potentially spend less time in custody if they are innocent or may proceed to trial quicker with all DNA evidence analyzed from the scene within days not weeks or months. Criminal cases can be filed quicker by the District Attorney and the concept of DNA may become just a little easier for a jury to understand.

According to Sharmin Eshraghi Bock, Deputy District Attorney for Alameda County (CA), the “CSI effect” (the impact of television programs featuring forensics) now plays an important role in criminal trials. Although DNA on a Chip would most likely find fast acceptance from juries, there will most certainly be legal and privacy issues raised (“The value of DNA Evidence”, 2001). But there is a major roadblock to overcome in our use of emerging DNA technologies. How do we know, with one hundred percent certainty, the DNA recovered might belong to a suspect?

**Roadblocks in the way**

If DNA recovered from a crime scene is not the suspect’s, whose is it? It certainly could be the victim’s, other family members, or innocent visitors to the scene. That’s easy to test and confirm by asking for a sample from family members. But could it be a first responder’s DNA?
Without a means to verify the identity of unknown DNA evidence, a profile in Combined DNA Index System (CODIS) may be created to seek out the “suspect” sample. Would this be difficult to resolve? What would it require?

According to the California Department of Justice DNA Databank Program, as of April 2010, there were over 31,307 forensic unknown profiles in CODIS that are searched against some 1.5 million offender profiles (California Department of Justice, Prop 69, DNA Laboratory monthly statistics, 2010). What are the possibilities that a small percentage of the forensic profiles are first responders? 1%, 5% or 10% percent? What amount is acceptable? Even a small number of first responders DNA in the databank are troublesome. One option would be to receive DNA at pre-hire just like we do now by receiving fingerprints from applicants. This does not, however, close the loop fully. To do that, all first responders must submit samples.

Are there legal or ethical concerns for an agency? Would it be cumbersome to test the current first responders? Would there be any resistance from tenured employees who aren’t use to or don’t believe in the success of technology as the current generation? Current staff may be too cynical and overly suspicious. Would there also have to be some written documentation in each personnel file that acknowledges what the test is and a certain guarantee of its privacy for the employee? The answer to all of these questions is something the first responder community needs to answer.

Defense Attorney Casey Nice, Livermore CA, expressed concerns about such a policy of first responders providing their DNA, saying “If provided, what guarantees would be put into place to safeguard the information” (Nice, 2010). “What else is the information going to be used for?” Nice expressed the anticipated attorney mindset of privacy concerns about pre-employment medical screening with possible denials pursuant to the knowledge of predisposition of family medical ill regularities. The knowledge that DNA provides information unlike
anything gained from a fingerprint is well known. Nice expressed concerns with the continuing demands by public service employers to provide pre-employment samples of blood, urine, X-rays and possible DNA could reduce individuals interested in public service employment. But with limited, controlled and restricted use of first responder DNA, significant progress could be made in solving hundreds of crimes that have no current police leads.

Just imagine all the current police, fire and emergency personnel nationwide that could offer their DNA for the cause, not to mention several retired members (we could also clear some cold cases, a thought that might prompt resistance from privacy groups and unions). 30 years ago police officers, fire and EMS personnel didn’t think about DNA like we do today. The last 15 years we have seen a lot of cold case units developed in an attempt to solve crimes. It is just as important to eliminate DNA that may be in the database that should be removed. What if the DNA from 30 years ago turned out to be a police officer or fire fighter that was involved in the investigation of the crime or present at the scene? The case may never be solved, yet the submitting law enforcement agency may have false hope that one day, their case would be solved only to sit in an electronic graveyard with no help of survival. Case closures most certainly will increase with the additional submissions of DNA evidence (Beckhard, R., & Harris, R. T. 1987). Providing a DNA sample is quite easy today with very little effort or expense needed.

**A buccal swab is all that’s needed**

According to FBI quality assurance guidelines, first responder DNA samples cannot be submitted and uploaded into CODIS. Kept in the local crime lab, though, they are a valuable source to eliminate unknown profiles from the evidence analysis process, according to Steve Hayes, Laboratory Director of the Alameda County Sheriff’s Office, (CA) Forensic Crime Laboratory (2010). The increase of first responder DNA should not have any adverse impact to
CODIS, as they are well prepared to handle the influx of submissions as states across the nation enact strict laws regarding Felony arrestees and violent predators (Maschke, K., (2007).

It is unchartered waters to discuss obtaining DNA samples from first responders; even though it can be obtained with very little intrusion from the body, by merely obtaining a buccal swab from the donor (a buccal swab involves scraping the inner cheek with a special swab). This procedure is fast and painless, and is usually a preferred method of obtaining a DNA sample over providing a blood sample (Genex, n.d.). Discussion should be initiated with union labor leaders to assess their level of comfort, due to the legal and medical concerns with obtaining ones DNA. If agreed upon by labor groups, we could ensure we are not populating the FBI DNA databank with unnecessary DNA profiles. Would labor groups for police, fire and EMS be supportive or opposed? Starting the discussions is the first step. Initially, these groups will be reluctant to be supportive even though they understand the reasoning behind the request. Bringing these groups to the table to de-mystify DNA and explain the safeguards surrounding the use, upload and maintenance of the first responder program will start the discussions.

Safeguards could be easily put into place to ensure anonymity to the DNA profile, but at least we would have some level of knowledge that we are not uploading a first responder’s DNA. FBI quality assurance standards for DNA databasing as noted earlier apply to all uploads into CODIS. First responders across the nation could voluntarily submit their DNA to their state or local crime laboratory only to be cross referenced locally with DNA recovered from a crime scene located within their area of jurisdiction. As medical and electronic technology advances exponentially, so does the advances in DNA. The key is to harvest this technology and put it to good use fighting crime.
DNA advancement continues

As DNA collection and analysis continues to advance, it is only going to get processed faster, with a profile identified faster and information provided to the detective faster. By raising the level of first responder expertise about DNA with our training, we can increase our efficiency at crime scene processing with a reduction in contamination and cross contamination of potential DNA evidence. First responder DNA submissions are extremely important to the success of this process, and with labor union agreements, we should see a real measured progress in our solvability factors from crime scene responses (Dale, Greenspan, & Orokos, 2006).

The first responder and public safety community must capitalize on this emerging technology and find ways to work together with union groups to initiate a voluntary policy of first responders providing their DNA to their local Crime Laboratory. If not accomplished this way, a DNA test for public safety employees may become a mandatory screening process in the future as a condition of employment for crime scene first responders.

The DNA Lab on a Chip could be the next greatest tool for law enforcement since the identification of fingerprints. Let’s do the right thing and provide a DNA sample now so we may someday reap the rewards of putting more bad guys in jail faster.
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