SWEET JUSTICE

DAVID SWEET IS REVOLUTIONIZING MODERN CRIME SCENE INVESTIGATION BY APPLYING DENTAL FORENSIC TECHNOLOGY TO IDENTIFY VICTIMS AND PROSECUTE CRIMINALS

When Dr. David Sweet, Director of the Bureau of Legal Dentistry (BOLD) at UBC Vancouver, arrived at the scene of a brutal crime in 1995, he never could've imagined that the technique he had recently developed to earn his Ph.D. would not only provide the missing link to solving the case but would also transform the way forensic dentistry is used to bring perpetrators of violent crimes to justice.

The brutality of the scene left little to the imagination that late October morning. Entangled in a myriad of weeds and branches, the body of a young woman had been found floating naked in a river. Police estimated that her remains had spent approximately five hours submerged in the river's frigid waters. The numerous bruises, which purpled segments of her body, clearly indicated that a violent struggle had taken place. As investigators spied her remains more closely, a curious series of impressions appeared to distort the soft tissue of her skin. Within hours, these impressions were identified as bite marks – a vicious but common form of physical and sexual assault. It was at this point that Sweet, a recently graduated Ph.D. student with expertise in bite-mark analysis, was called in to recover and analyze the evidence.

The frequency with which bite marks appear on victims of sexual assault or sexual homicide produced a modern approach to crime scene investigation that complemented traditional DNA analysis. Bite-mark identification involves a comparative analysis of a suspect's teeth and the physical impressions and bruises left on the victim's

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Photos> David Sweet

skin. Although proficient in this method, Sweet was frustrated with the limitations that this type of evidence posed, compelling him to search for a more effective means of analysis.

"Skin is elastic, it's distortable and it's prone to change so I was uncomfortable in identifying one person as the biter, to the exclusion of all others, then go to court to testify this is the only person that could've done this," Sweet says. "But I started to read that in the early 1990s, somebody had taken a postage stamp that had been licked onto an envelope and they were able to get DNA from this saliva."

Using this fragment of knowledge as his driving incentive, Sweet began to develop a technique that involved retrieving saliva off bite marks for his doctoral thesis. The results from the saliva swab can conclusively identify a suspect and it can work to either strengthen or refute other DNA evidence such as semen samples. Although the method was lauded by his professors and colleagues, a real-life application had yet to be tested. When Sweet was called in to investigate the bite marks on the woman's body, the opportunity to test his technique finally materialized.

"I began swabbing the woman's bite mark for saliva but the police officers beside me were joking, 'Doesn't he know that she's been in the water for over five hours? It has all washed off!'" Sweet laughs. "But I knew it was standard operating procedure and if I didn't do it, I would have to answer in court why I didn't do it. So I used the procedure not expecting to be successful in this particular case."

To Sweet's surprise and delight, the evidence from the saliva on the bite mark returned packed with vital DNA information. Even though her body was in water for more than five hours, the sticky part of the saliva had kept the cells completely in tact. Investigators were then able to compare Sweet's saliva samples with semen samples taken at the autopsy to positively identify a single suspect, who was later convicted of second-degree murder in the case.

"Most doctoral students hope their research is going to be useful and they dream that it is," said Sweet. "The very first case that I was involved in when I returned from Europe after my Ph.D. was a home run. I know that victim's families appreciate that justice has been done because of these and other methods we have developed here at UBC have prosecuted people that were involved. There is no need to wait for the research to be used; it is used every day. I don't think it gets any better than that."

The technique, now known as double swabbing or "Sweet swabbing," is employed by forensic experts around the world to prosecute criminals. It is also one of the innovative techniques that have put Sweet and UBC's BOLD laboratory on the forensic dentistry map. Opened in 1996 through a $500,000 grant from the BC provincial government, BOLD is Canada's first facility devoted exclusively to police work, research and instruction in the use of forensic odontology, or the science of victim identification using dental characteristics for crime investigation and prosecution. Sweet has taken the techniques he developed at BOLD to impact more than 700 forensic cases from the Pickton murder trial in Vancouver to the tsunami disaster in Thailand. In fact, most teeth and bones found in Canada that are used for DNA analysis are sent to BOLD for processing using a technique Sweet developed called cryogenic grinding, which involves extraction of DNA from hard tissues inside teeth or bone: "I hypothesized that if you make teeth into particles instead of a single entity, it will be far easier to find and extract the DNA from each one of those cells embedded inside the tooth," explains Sweet. "If we pulverize the tooth, these cells will be at the surface. Then you open up the cell and take out the DNA so it's a very common sense and straightforward procedure."

Sweet's contributions to the field of forensic dentistry have not gone unnoticed by the international community. After leading the Canadian forensic dentistry Disaster Victim Identification (DVI) team in the successful identification of all Canadian victims in the tsunami disaster, Sweet was named chief scientist for Interpol's DVI Standing Committee, a role he was elected to by its members.

But despite pioneering innovative technology that is used around the world, the BOLD lab still has an uphill battle when it comes to securing its existence on a year-to-year basis. Sweet estimates that BOLD needs at least $150,000 each year to stay in operation but because traditional science does not support death investigation and related forensic research, applying for grants like other professors isn't an option.

"The traditional grants that professors rely on to fund their research is not available for forensic science in Canada," Sweet comments. "We don't have a national institute of justice like the US that supports this kind of research. And because it's not basic science or medical research, it's not funded by the Canadian Institutes of Health Research (CIHR)."

As a result, Sweet and the BOLD lab have developed an innovative business model that relies on fee-for-service casework. Because BOLD has technologies and services that aren't available anywhere else in the world, the service component of the lab is never without work. Municipal, national and international police agencies and others have started to rely on BOLD to answer critical questions that arise at the crime scene. In order to balance casework with research, the lab has had to work long hours and take on extra casework, which puts a strain on human resources, limits new funding opportunities and makes it nearly impossible to keep up with current technology.

Even so, Sweet remains consistently humble and optimistic about BOLD's future: "I am very proud of the fact that my lab is a shining example of the trident approach that every university tries to impress upon every faculty member: research, teaching and service. I am involved in all of those areas in a very big way. What better role can a university professor play than developing technology the scientific community, students and public can appreciate and use?"