

WG 6 (Forensic Pathology)

Race Against the Clock: Outpacing Social Media with Rapid and Accurate DNA Identification

Reouven Berdugo.

Unit for Identification and Investigation of Death Circumstances, Medical Corps, Israel Defense Force.

The lecture will highlight the activities of the Genomic Center for Casualties Identification under the Chaplaincy Corps, focusing on its operations on October 7th, 2023, and in the sequential period. It will explore the challenges of DNA identification detailing the grim progression from analyzing fresh samples to decomposed samples, then to fresh bones and teeth and ultimately to highly degraded bone samples. Additionally, the lecture will address the centers' role in the effort to locate missing persons inside and outside the borders of the country, the significant amount of evidence retrieved from hostile homes in the Gaza Strip and war tunnels.

Mass casualty events during the war, such as the explosion of a demolition truck, highlighted the urgent need for extremely quick and accurate identification. In one instance, the task was to identify six presumably missing soldiers from various small remains as quickly as possible, ensuring no soldiers were missing and enabling the army to notify families and deliver the devastating news. In this case, the genomic center successfully generated profiles from several samples in just three hours, providing definite proof of death for all six presumably missing soldiers. Following this, the team processed more than 200 samples in 24 hours, enabling timely burial, with each coffin containing the appropriate remains. Another scenario, at the Shifa Hospital, is an example of large-scale corpse sampling and identification in an effort to locate missing Israeli citizens – a true 'needle in the haystack' challenge. Similarly, the "Yemen Field" operation involved sampling more than 1500 terrorist bodies in advanced stages of decomposition, driven by the hope of finding even one missing individual. The Genomic Center demonstrated remarkable technological advancement during the war, including the acquisition of wartime validation of rapid identification systems such as ANDE and RapidHIT. These systems enabled the rapid identification of challenging samples under critical conditions. On the Northern front, the Genomic Center established the Tsiporit Rapid DNA Identification outpost during the war. Equipped with two RapidHIT machines, this facility was capable of handling smaller scale events locally, eliminating the need to transfer bodies or samples to the main Genomic Center in Shura.

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Advancing Forensic DNA Profiling with Nanopore Sequencing Technology

Amit Blumberg, Noam Shomron.

Medical Corps, IDF.

Forensic DNA analysis faces critical challenges in handling low-quality and degraded samples, limiting the reliability of traditional short tandem repeat (STR) profiling. Here we present an innovative approach leveraging Nanopore sequencing for single nucleotide polymorphism (SNP) profiling, combined with STR, addressing these limitations. Our project integrates advanced bioinformatics, wet-lab experimentation, and engineering to develop a comprehensive system for DNA extraction, quantification, and profiling. Nanopore sequencing enables real-time analysis of DNA fragments, preserving critical genetic information from degraded samples and enhancing accuracy. We are also developing a microfluidic device for streamlined sample preparation, aiming for rapid, robust, and field-deployable solutions. This multidisciplinary effort lays the groundwork for a transformative forensic workflow, capable of achieving precise individual identification from challenging biological evidence, expediting forensic investigations, and paving the way for future advancements in forensic genomics.