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## PREDICTING GEOLOCATION FROM VIRAL DNA USING AI

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Persistent human DNA viruses are globally distributed, typically acquired early in life, and leave stable genomic traces in host tissues, thereby illustrating viral evolution and reflecting relationships among human populations. This viral "fingerprint" may complement human genomic data as a biogeographic marker, particularly in settings where reference datasets are limited or fragmented. We assembled 24,441 near-full-length genomes from NCBI GenBank, representing 29 human DNA viruses across five families (Polyomaviridae, Herpesviridae, Papillomaviridae, Parvoviridae, and Hepadnaviridae) with metadata extracted from database records and primary literature. Phylogenetic analyses were conducted using BEAST2, and machine -learning models were implemented through the mGPS framework to infer the geographic origin of viral sequences. Phylogenetic reconstructions revealed continent- and country-level clustering for numerous viruses, including BKPyV, JCpV, HHV1, HHV2, HHV3, HHV6B, HCMV, HPV16, HPV18, HPV31, HPV45, and HBV. Geographic structure was strongest in regions with sufficient sequence representation, whereas global data availability remained highly uneven. Sixteen viruses met the sample-size criteria for mGPS modelling, yielding weighted F1 scores from 0.7663 to 0.9980, indicating robust continent-level predictivity despite dataset imbalance. Overall, several persistent human DNA viruses (14 of 29) show promise as biogeographic markers, offering a complementary tool for forensic identification and population studies. Integrating phylogenetics and machine learning enables inference of host geographic origin, although broader global sequence representation, improved metadata standards, and appropriate ethical frameworks will be essential for future applications.

**Keywords:** forensic genetics, geolocation, human DNA viruses, persistent DNA viruses, ancestry markers

# ABSTRACTS OF INVITED LECTURES – AMERICAN ACADEMY OF FORENSIC SCIENCES

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## REVISITING THE CT-43 CRASH NEAR DUBROVNIK AFTER THREE DECADES: FORENSIC INQUIRY, DIPLOMATIC LEGACY, AND CROATIAN–AMERICAN PARTNERSHIP

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On 3 April 1996, a United States Air Force CT-43A aircraft carrying 35 occupants crashed into the mountainous terrain above Dubrovnik while on approach to the airport, resulting in the deaths of all those on board. For the United States, the accident claimed the life of the Secretary of Commerce, along with twelve members of an official government delegation, thirteen representatives of the business community, six members of the flight crew, and one journalist. For Croatia, the event meant the loss of a Croatian interpreter and journalist and transformed what had been planned as a diplomatic visit symbolizing partnership and support into a tragedy on Croatian territory. This article considers the CT43A accident not solely as an aviation disaster, but as a historical and forensic case positioned at the intersection of international diplomacy, national remembrance, investigative practice, and collective mourning. Using official aviation investigation findings, Croatian police and forensic records, U.S. governmental and congressional documentation, and contemporary commemorative materials, the study reconstructs the objectives of Secretary Brown's mission, the circumstances leading up to the crash, and the coordinated Croatian efforts in search, recovery, and victim identification. The article argues that the CT43A tragedy should be viewed beyond the technical and operational factors that led to the accident. Equal attention should be given to the broader diplomatic context of the mission and to the professional, humane, and organized response of Croatian institutions. On the occasion of its thirtieth anniversary, the event emerges as a significant chapter in Croatian-American relations and shows that forensic history can serve not only analytical purposes but also as a form of commemoration.

**Keywords:** CT-43A crash, aircraft accident investigation, DVI, Croatian-American relations, forensic history

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## THE RON BROWN FORENSIC CONTROVERSY

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The April 3, 1996 crash of a U.S. Air Force CT-43 aircraft near Dubrovnik, Croatia resulted in the deaths of U.S. Secretary of Commerce Ron Brown and 34 others during an official trade mission. Although the official investigation concluded that pilot error, navigational deficiencies, and adverse environmental conditions caused the crash, unresolved forensic concerns regarding the postmortem investigation continue to generate discussion. The goal of this presentation is to retrospectively evaluate forensic procedures performed following the disaster and examine unresolved medicolegal questions surrounding the death investigation. Materials reviewed include publicly available aviation investigation findings, military forensic documentation, pathology reports, congressional correspondence, media archives, and records related to victim identification. Special attention is directed toward forensic odontology procedures used in victim identification, reported cranial injuries, the absence of a complete autopsy, missing radiographic evidence, and chain-of-custody concerns. Review of the available evidence demonstrates that while victim identification was completed and the official cause of death was reported as blunt force trauma, unanswered questions remain regarding documentation standards and forensic transparency. This case emphasizes the importance of comprehensive autopsy protocols, preservation of radiographic evidence, multidisciplinary forensic collaboration, and independent review in high-profile mass fatality investigations.

**Keywords:** Ron Brown, forensic odontology, aviation disaster, death investigation, mass fatality identification