DNA Nano-Taggants for Covert Watermarking, Tracking and Communication

Accomplishment: A simple, compact, low-cost method to produce, apply and detect DNA-tagged items was developed. These detection methods can provide rapid, reliable detection of DNA taggants in the field.

Impact: DNA taggants are an information assurance technology for objects with restricted access that verifies access and gives effective, covert tamper detection. They also provide watermarking to validate authenticity of sensitive documents and to verify human assets. For intelligence operations, taggant-encoded information can provide covert communications and the mapping of networks of personal contacts.

Motivation and Approach: DNA taggants are distinctive combinations of synthesized DNA that can be applied to surfaces, objects, materials or personnel. Like nanometer-sized barcodes, they enable the origin of the tagged article to be verified, traced and monitored for movement. DNA taggants consist of molecules that are each typically 3 nanometers in diameter by 10 nanometers long, and so are extremely discreet and difficult to detect by ordinary methods. Current DNA taggant technologies require the tagged sample to be sent to a laboratory, where the time to verify a DNA signature is on the order of hours. In military and intelligence applications, removing the article of interest to a testing facility is unacceptable and much shorter detection times are needed.

This research developed a technology to create unique libraries of DNA taggant sequences. Methods to apply or disperse the taggants were developed, and the adherence and viability on a variety of surfaces was demonstrated. The taggants were shown to be transferable between different surfaces, such as keyboards, currency, data storage media and painted surfaces, and were made more robust on surfaces containing other substances such as polymers. Two techniques for rapid, portable detection of DNA taggants were developed. Both methods take just minutes, and a positive detection is easily viewed by a color change. The detection kit requires only a 5 millimeter square absorbant pad containing the reagents that carry out the detection reactions. These taggants were verified to be non-toxic for human handling.

Team: The research was conducted by Prof. John Reif (Eagle Eye, Inc.), with contributions from Prof. Tom Lebean (Duke University) and Prof. Hao Yan (Arizona State University). Dr. Thomas Renz at the Information Directorate gave guidance on relevant military applications. The research was funded by a Small Business Innovation Research project from the Information Directorate.