Hair strands could reveal lifestyle secrets of criminals

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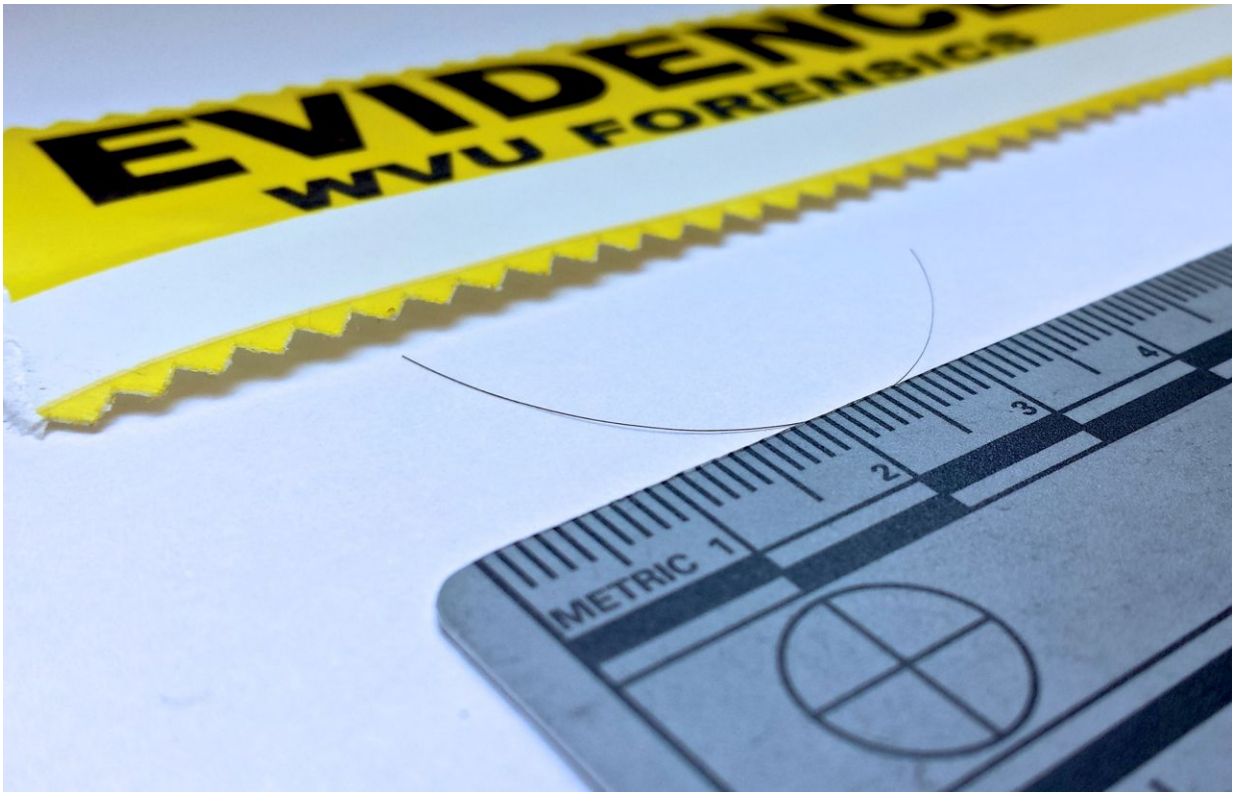

Emerging hair analysis techniques could help reveal vital lifestyle information about crime suspects. Credit: Glen P. Jackson, Ph.D.

Hair fiber analysis, a forensic crime tool with a questionable past, could soon have a brighter future thanks to the development of a more refined scientific technique that could reveal much about a person's lifestyle.

Scientists say the new technique could potentially provide investigators with vital clues about a person's age, sex, body mass, diet and exercise habits that could help them hone in on potential suspects.

The researchers will present their work today at the 253rd National Meeting & Exposition of the American Chemical Society (ACS).

"Who you are, where you've been, what you eat, what drugs you take—it all shows up in your hair," says Glen P. Jackson, Ph.D. "Depending on the question being asked, the chemical analysis of human hair can provide amazing insights into the life and lifestyle of a person."

Forensic hair analysis was once a mainstay of criminal investigations and courtrooms. The technique relied on microscopic examination of hair color, thickness and curvature to identify suspects and link them to crime scenes. However, critics have long argued that hair analysis is subjective and that experts have overstated its reliability. In fact, a recent review conducted by the U.S. Department of Justice found that 90 percent of hair examiners' testimonies in criminal trials contained erroneous statements. As a result, several people who were convicted based on hair-sample analysis were later found to be not guilty. Jackson says forensic investigators still collect hair samples but rarely use them anymore.

Instead, DNA testing is the current gold standard in criminal cases. But Jackson, who is at West Virginia University, says hairs found at crime scenes often don't have enough viable DNA in them for analysis. And even if DNA is available, a matching sample might not be found in existing criminal databases. In addition, DNA only provides a genetic profile of a suspect and reveals nothing about the person's lifestyle, which could be key to breaking a case. For example, as Jackson explains, "You could have genetically identical twins, and if one is obese and one is lean, we potentially could tell the difference between their hairs with

our method," Jackson says.

Jackson and his team decided to delve deeper into the chemical composition of hair to see if they could develop a scientifically rigorous technique to identify certain lifestyle characteristics of criminal suspects and their victims.

Using liquid chromatography in conjunction with isotope ratio mass spectrometry (LC-IRMS), the researchers measured the ratio of isotopes (atoms of the same element that have differing numbers of neutrons) within the 21 amino acids found in keratin, the primary constituent of hair. This method is not too difficult for a technician to perform and is, therefore, becoming more common in crime labs.

With the approach, the team identified 15 isotope ratio measurements that potentially could yield crucial information about certain lifestyle habits of individuals. To test this possibility, a researcher in Jackson's group collected hair samples from 20 women in Jordan, the lab member's native country. Prior to LC-IRMS measurement, the women completed extensive questionnaires about their lives, including their health, hair care and diet. In a blind evaluation based on these hair samples, Jackson's team was able to predict a subject's body mass index with about 80 percent accuracy, using a cross-validation approach. Recently, the researchers conducted a similar study among 20 American men and women and found that they could accurately identify the sex of a donor with 90 percent accuracy.

While promising, Jackson says far more work needs to be done before this technique can be used in crime labs. The team needs to bolster its pool of hair samples and refine its methodology. For now, the analysis requires several strands of hair from the same person, which could make it difficult to use in forensic settings where only a single strand may be available. But if these issues can be worked out, then LC-IRMS analysis

of amino acids in hair could eventually be a complementary forensic tool to DNA analyses, filling in gaps that genetic materials alone can't plug, he explains.

More information: Forensic attribution using stable isotopes: Hairs to humans and insects to carrion, the 253rd National Meeting & Exposition of the American Chemical Society (ACS), 2017.

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