Scientists hit on the protein and lipid composition of the Siberian mammoth bone

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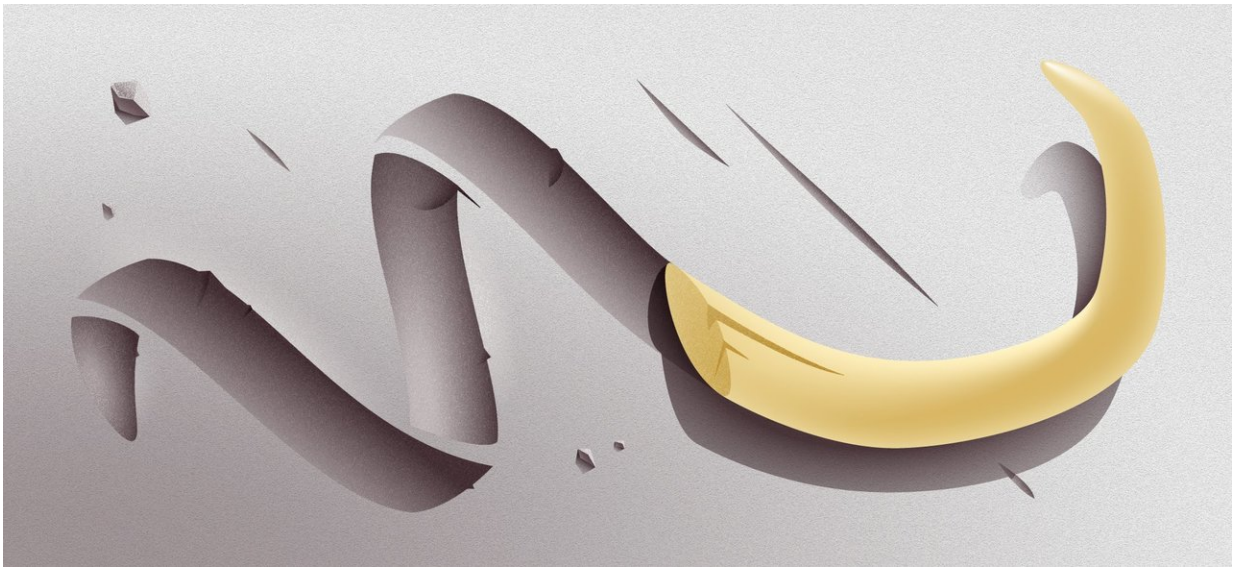

Credit: @tsarcyanide/MIPT

Scientists from Skoltech and Moscow Institute of Physics and Technology (MIPT) studied the protein and lipid composition of a mammoth bone found near the Yana River in northeastern Siberia. Their study is one of the few pioneering endeavors in paleolipidomics—a frontier research area that complements paleogenomics and paleoproteomics. The results of their study were published in the *European Journal of Mass Spectrometry*.

Scientists worldwide took interest in the molecular composition of the remains of extinct creatures several decades ago. Advanced methods of genetic analysis have made it possible to study DNA extracted from fossilized bones, giving rise to a whole new trend in science, paleogenetics, that has helped crack a lot of evolutionary mysteries. Nevertheless, genetics alone is hardly enough to get a full picture of the animals that inhabited the Earth long before humans. In living organisms, the protein and fat composition is nearly as essential as DNA. This is why at some point paleogenomics was joined by paleoproteomics that studies ancient proteins. The lipid molecules, most of which are extremely unstable and could not be preserved for millions of years, were largely disregarded. However, some lipids experienced oxidative stress and turned into fossils that can be studied and may provide valuable insights into what our ancestors ate, what ailments they suffered from and how well-developed their nervous system was.

Relying on both paleoproteomics and paleolipidomics and applying advanced liquid chromatography and mass spectrometry methods, the scientists from Skoltech and MIPT identified 98 proteins and 73 lipids in the bones of the Siberian mammoth and compared their findings to the bone analysis results for the modern African elephant.

"We found collagen that forms the core of the bone tissue along with other protein varieties, such as albumin, lumican, osteoglycine, and alpha-2-HS-glycoprotein, that regulate various processes in the body. As for lipids, it transpired that very few can last that long. We found only triglycerides but no phosphatidylcholines or sphingomyelins," said Yury Kostyukevich, the author of the study and senior research scientist at MIPT and Skoltech.

"We applied our experience in the mass spectrometry analysis of various biological samples to analyze fossilized bones in an attempt to expand the horizons of mass spectrometry in various fields of science.

Proteomic and lipidomic approaches based on mass spectrometry proved to be remarkably effective in biomedical research and may also prove useful to archaeologists and paleontologists," explained Professor Eugene Nikolaev.

Proteins are known to serve as markers of various diseases. Some studies show that analyzing fossilized human remains can help determine the diseases humans suffered from. It is not quite clear though what information the bone tissue lipids can provide. In their recent study, the scientists set out to find out which lipids can survive in fossilized remains for tens of thousands of years. According to the Skoltech and MIPT Professor Evgeny Nikolaev, future research will help to answer this question.

More information: Yury Kostyukevich et al, Proteomic and lipidomic analysis of mammoth bone by high-resolution tandem mass spectrometry coupled with liquid chromatography, *European Journal of Mass Spectrometry* (2018). DOI: 10.1177/1469066718813728

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