The smell of iron

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Where does the strange but typical "metallic" smell come from when we touch iron objects such as tools, utensils, railings, or coins? "The smell of iron upon contact with skin is ironically a type of human body odor," states Dietmar Glindemann.

"That we are smelling the metal itself is actually an illusion." In conjunction with a team of researchers from the Virginia Polytechnic Institute and State University in the United States, The University of Leipzig and the Leipzig Environmental Research Center, Germany, he has tracked down the responsible scent molecules.

Seven test subjects immediately recognized the "musty" metallic odor when their hands came into contact with metallic iron or a solution containing iron ions with a twofold positive charge. In contrast, solutions of iron with a triple negative charge did not cause the odor. Analysis of gas samples from the skin of the test subjects pointed to a bouquet of different organic compounds that seemed to be characteristic of the metallic smell.

The key component is called 1-octen-2-one, which smells fungal-metallic even when highly diluted. The precursors to the odor molecules are lipid peroxides, which are produced when oils on skin are oxidized by certain enzymes or other processes (e.g. under UV light). These lipid peroxides are then decomposed by the doubly negative iron ions, which are consequently reduced to triply negative iron ions. When touching objects made of iron, the required doubly negative ions are formed when perspiration on the skin corrodes the iron.

Rubbing blood over skin results in a similar metallic smell based on the same scent molecules. Blood also contains iron atoms. Says Glindemann, "That humans can 'smell' iron can be interpreted as a sense for the smell of blood. Early humans were thus probably able to track down wounded prey or tribe members."

Based on this new knowledge, medical researchers should be able to further develop iron tests for skin, blood and tissues in order to identify specific "fingerprints" of volatile scent molecules as markers for individual body odor, oxidative stress, and diseases.

The researchers were also able to characterize another iron-type smell: carbon- and phosphorus-containing cast iron and steel develop a metallic-garlic odor when exposed to acids. Until now, metallurgists ascribed this to the gas phosphine (PH_3). However, at breathable concentrations, pure phosphine (also known as a pesticide) is basically odorless. The true culprits are organophosphines, especially those champions among intensively smelly compounds like methylphosphine and dimethylphosphine. Their structure is like that of a phosphine molecule in which one or two of the hydrogen atoms are replaced with methyl (CH_3) groups.

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