Here's how your body transports zinc to protect your health

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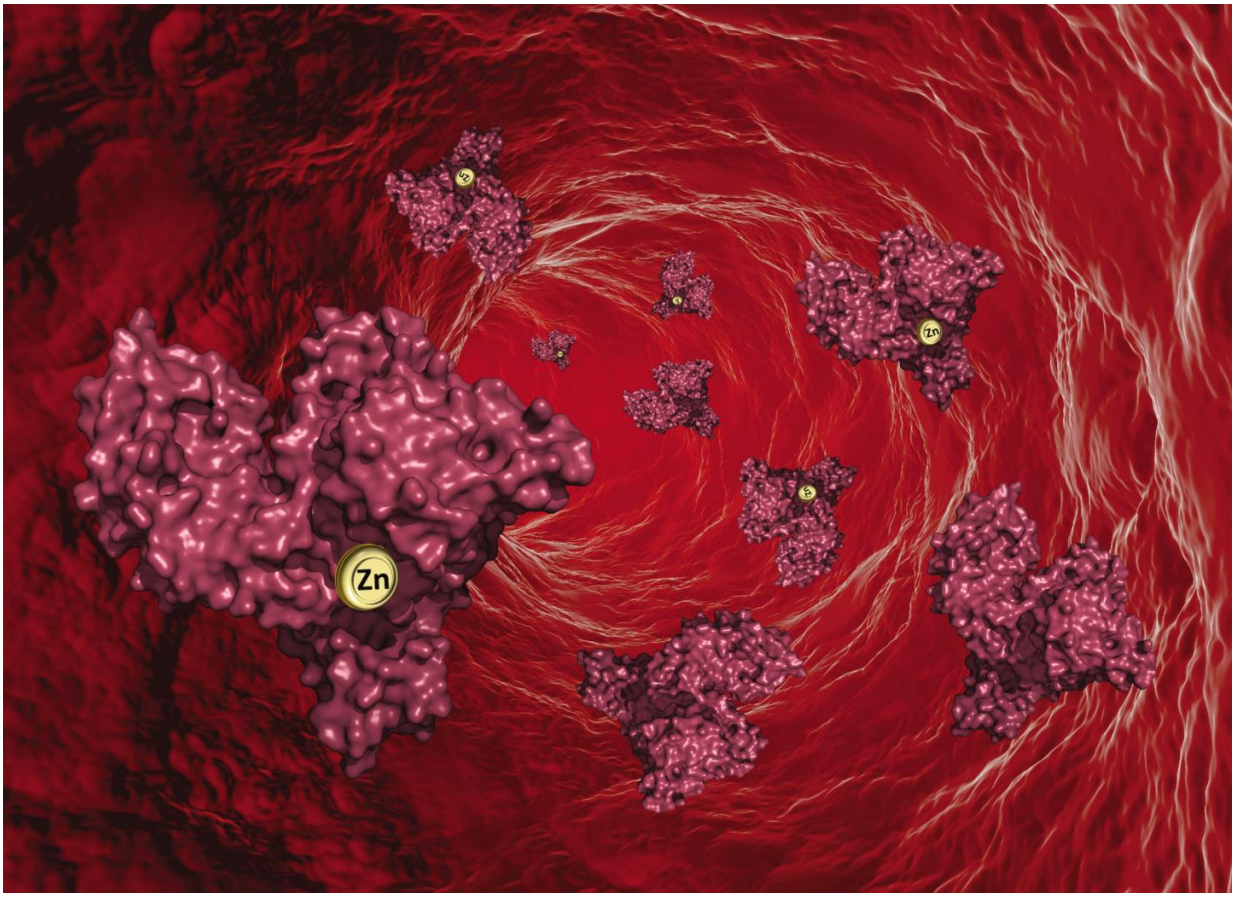

An artist's interpretation of zinc being transported in the bloodstream. Credit: Wladek Minor

Zinc is essential for wound healing, for vision, for DNA creation, for our

senses of taste and smell, even for sexual health. But despite its importance, scientists have never fully understood the mechanism that moves the mineral through the body - until now.

Researchers have, for the first time, created detailed blueprints of the molecular moving vans that ferry this important mineral everywhere it's needed through the blood. The finding gives scientists new insights into this important process - and a deeper understanding of the critical role it plays in maintaining good health.

The work represents an international collaboration among researchers at the University of Virginia School of Medicine and colleagues at the Universities of South Carolina (Maksymilian Chruszcz), Warwick (Claudia A. Blindauer) and St. Andrews (Alan J. Stewart).

Surprising Findings

Zinc is carried through the body by a protein known as serum albumin. Scientists had expected there would be a primary binding site where serum albumin binds with zinc, and the UVA researchers proved the location of that site. But the team, led by UVA's Wladek Minor, PhD, also found several more secondary binding sites, revealing a more complex interaction than anticipated. "It's different than it was predicted before," said researcher Katarzyna B. Handing, PhD.

While computer models previously had been used to predict how serum albumin picks up zinc, Minor's team used a scientific technique called X-ray crystallography to create colorful images of zinc actually bound to serum albumin. The technique allows them to pinpoint the location of each particular zinc atom. It was a challenging task, but the resulting schematics allow scientists to see, for the first time, exactly how serum albumin and zinc come together.

A Healthy Balance

With the finding, scientists have a better grasp of how the body maintains the delicate balances necessary for good health, a state known as homeostasis. It's a complex dance made all the more complicated by the fact that serum albumin also transports many other things, such as hormones and fatty acids. "Homeostasis is extremely important, and it can be affected by the level of zinc you are taking into your body. But it can be also affected by other elements," Handing said. "If you have an elevated level of fatty acids, for example as a result of diabetes or obesity, the zinc homeostasis can be disturbed."

This is important because the body needs zinc, but too much zinc is toxic. So the body must make it available where it is needed, but, at the same time, it must prevent excessive buildup. If something goes wrong with the zinc regulation process, that can have a ripple effect, throwing the body's delicate balances out of whack and potentially having serious effects on health.

Implications of the Discovery

Ivan G. Shabalin, PhD, a research scientist in Minor's lab, noted that the research could help shed light on why certain drugs affect some patients differently than others.

"We are going towards an understanding of all these complex relationships," he said. "You have this one molecule [serum albumin], and you have hundreds - possibly thousands - of different molecules which bind to it. We need to understand all this interplay. By studying zinc binding to albumin, we are understanding this relationship deeper."

Findings Published

The findings have been published in the scientific journal *Chemical Science*. The paper was authored by Handing, Shabalin, Kassaar, Khazaipoul, Blindauer, Stewart, Chruszcz and Minor. Minor is a faculty member in UVA's Department of Molecular Physiology and Biological Physics.

More information: Katarzyna B. Handing et al, Circulatory zinc transport is controlled by distinct interdomain sites on mammalian albumins, *Chem. Sci.* (2016). DOI: 10.1039/C6SC02267G