

Heavy metals have a bad reputation but they can also help cure cancer, claims researcher

September 6 2023, by Sabine Waasdorp



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Many people think heavy metals are poisonous and always harm people and the environment. The reality is more nuanced, says Professor Sylvestre Bonnet. In his inaugural lecture he claims that heavy metals can actually help cure diseases such as cancer.

"I became interested in metals during my master's placement at Jean-Pierre Sauvage's lab," Professor of Chemistry Bonnet explains. "His lab focuses on molecular machines that can also contain metals [molecular machines are assemblies of atoms that carry out tasks like machines]. I had consciously chosen his lab because I was really impressed by an

article where he showed how you can control [molecular machines](#) with light."

Activating drugs with light and the metal ruthenium

Molecular machines and light also take center stage at Bonnet's lab. He and his research group are developing a form of chemotherapy that only works when you shine light on it. This greatly reduces side effects—whereas regular chemotherapy drugs also poison [healthy cells](#), this form of chemotherapy ensures that the drugs only work once they have reached the tumor and light has been shone on it.

The element in the drug that makes this later light activation possible is the metal [ruthenium](#), a special metal according to Bonnet. "What is unique about ruthenium is that it makes a molecule stable in the dark. Whereas a molecule with copper soon begins to react to organic cells in the body, ruthenium only does so when activated by light.

"Ruthenium can also absorb different types of light, such as green, red or [infrared light](#). This makes it suited to healing different kinds of tumor. Green light only penetrates the skin to a depth of a few millimeters, whereas infrared light can penetrate to a depth of two centimeters."

Undeservedly bad reputation

Ruthenium is currently already being used to cure eye cancer but does not yet have the good reputation Bonnet would wish for it. "The problem is that people think that all heavier metals are toxic, so also a somewhat more unfamiliar metal such as ruthenium. If people see one ruthenium atom, they immediately assume that the whole molecule is toxic. But it's not that one ruthenium atom but the combination of atoms with that ruthenium atom that make a molecule toxic or safe."

Bonnet thinks there is still a long way to go before drug manufacturers embrace ruthenium. But he remains hopeful, also because the research into metal drugs is only increasing. "A lot of experiments are being done with chloroquine, a malaria [drug](#). As many mosquitoes are now resistant to chloroquine, various metals are being added to it to allow us to fight the malaria that these mosquitoes spread. These experiments are already yielding interesting results."

Bonnet hasn't yet finished experimenting either. "We are now doing a lot of research into where exactly in the body the ruthenium-containing molecule ends up after being injected into the body. You can only start shining light once the ruthenium-containing molecule has reached the tumor. We are also conducting research into which light works best for which tumor. By researching these fundamental aspects, we will hopefully be able to advance cancer therapy."

Provided by Leiden University

Citation: Heavy metals have a bad reputation but they can also help cure cancer, claims researcher (2023, September 6) retrieved 12 May 2024 from <https://medicalxpress.com/news/2023-09-heavy-metals-bad-reputation-cancer.html>

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