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## Metal containing nucleosides that function as therapeutic and diagnostic agents against brain cancer

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Personalized medicine incorporates the concept of tailor-made drugs and medications applied to individual patients to efficiently treat many illnesses. By applying the concept of “theranostics”, fluorescent biophores that serve dually as therapeutic and diagnostic agents, can be used for biological imaging, testing and treatment, while eliminating the use of more dangerous, radioactive, and unstable materials. Nucleoside transporters play important roles in the increased nucleoside metabolism necessary for the higher levels of DNA and RNA synthesis associated with hyperproliferative capabilities of cancer cells. In this study a series of metal containing nucleoside (MCN) analogues have been used as novel chemical agents to study how nucleosides are imported into cells. The transport and toxicity of cyclometalated iridium nucleosides, designated Ir(III)-PPY, Ir(III)-BZQ, and Ir(III)-PBO, have been evaluated against a glioblastoma brain cancer cell line, U-87. Cell viability experiments demonstrate that all compounds induce cell death in a time- and dose-dependent manner. Significant nuclear localization is detected at longer times (~24 hours), corresponding with the onset of cell death and provides insight into the mechanism of action of these MCNs. The collective photophysical properties of these fluorescent MCNs were also used to visualize their intracellular distribution throughout localized regions of the cell. The ability to measure the uptake of MCNs coupled with their anti-cancer activities define these novel nucleoside analogues as “theranostic agents.” Further development of cyclometalated iridium chemotherapeutics from non-natural nucleosides as mechanistic probes against cancer propose safer and more effective methods of diagnosis and treatment for many illnesses associated with hyperproliferative cells.

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## What is the role of diffuse double layer (DDL) processes during electrolytic reduction in a low-oxygen environment?

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Heavy metals typically accumulate in reduced bottom sediments after being discharged into waterways by industrial and municipal processes. Copper in particular is widely used as a major component of electronic devices. Cu(II), the most prevalent form of Cu in the natural environment, is highly water soluble. A laboratory experiment was conducted in order to determine if abundance of clay in the bottom sediments of a Cu-contaminated aqueous ecosystem could enhance electrolytic reduction of the heavy metal to the less mobile (Cu(0) or Cu(I)) forms.  $\text{Cu}(\text{NO}_3)_2 \cdot 2.5\text{H}_2\text{O}$  was added to simulate a moderately contaminated system with 650  $\mu\text{g}$  Cu/ml kaolinite clay-water slurry. A constant electrical potential of 1.0 V/cm was applied across platinum wire electrodes inserted into the continuously stirred system for four days while the system ORP was monitored and periodic sub-samples were taken for analysis. The electrical as well as the chemical results indicate that the quantity of Cu(II) being reduced to Cu(I), especially within the aqueous phase, is increased within the first 48 hours of experimentation by the presence of kaolinite clay up to 0.05 mg clay/liter slurry. Though an electric current is necessary to initiate and sustain the non-spontaneous redox reaction, we were able to demonstrate that the clay content of the soil matrix itself may determine the subsequent efficiency of the reduction process. Under an applied current, the clay DDL behaves as capacitor for charge storage in this natural system and is aiding the heavy metal clean-up process.

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