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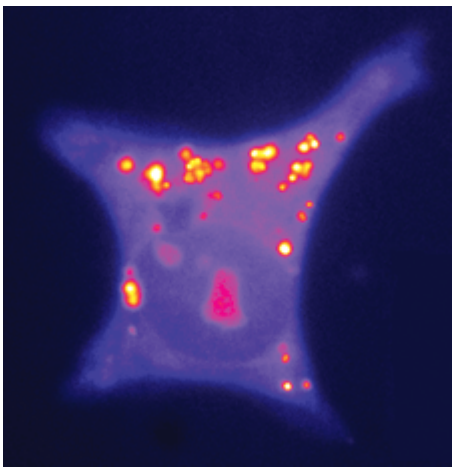
Tracking metal complexes in cancer cells



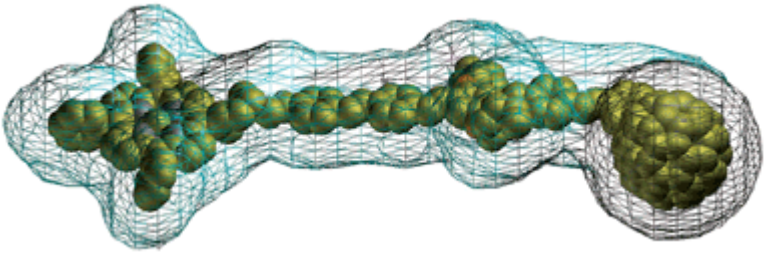
UNIVERSITY OF OXFORD CHEMISTRY DEPARTMENT IMAGE

The first fluorescence measurements of the uptake and distribution of metal thiosemicarbazone complexes in living cells have been carried out at the University of Oxford, in England [*Chem. Commun.*, **2005,** 845]. Chemistry professor Jonathan R. Dilworth and coworkers prepared a range of fluorescent zinc bis (thiosemicarbazone) complexes by the reaction of zinc acetate with various bis (thiosemicarbazones). Some zinc thiosemicarbazone complexes are known to be active as antitumor agents. "Although fluorescence of organic molecules is widely used in studies of cells, its use to track the cellular distribution of biologically active metal complexes has been less common," Dilworth says. Fluorescence images of the zinc complexes in living human cancer cells, such as the ovarian cancer cell (shown), reveal significant uptake of the complexes in the nucleoli. The uptake is dependent on the type of cancer cell and the peripheral substituents on the complexes. The team is now conducting studies to see if reduction of nonfluorescent copper(II) complexes to copper(I) complexes can switch on fluorescence images that enable the redox processes within cells to be mapped.

Oligomer behaves like molecular wire

By tethering a zinc porphyrin to a buckyball via an oligo-*p*-phenylenevinylene (oPPV) chain, a European team has built a series of small-molecule electronic communication systems [*Chem. Eur. J.*, **11,** 1267 (2005)]. The group, led by Nazario Martín of Madrid's Complutense University and Dirk M. Guldi of the University of Erlangen, in Germany, designed these molecular triads (one of which is shown) to prove that π-conjugated oligomers can behave like molecular wires. The zinc porphyrin moiety at one end of the molecule can act as an electron donor when it's photo- or electroexcited. The fullerene at the opposite end acts as an electron acceptor. In the ground state, there's no significant electronic communication between these two moieties. Only when the porphyrin unit is excited do the researchers observe electron transfer from one end of the molecule to the other. Martín notes that

because the molecule can convert sunlight into electricity, it is a good mimic of photosynthesis.



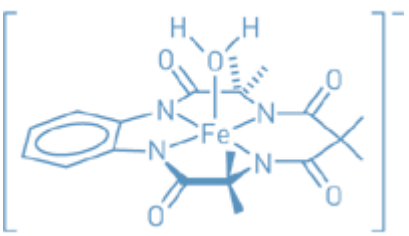
Simpler stem cell diet

By discovering two proteins that guide the growth of human embryonic stem cells, researchers have eliminated the need for mouse "feeder" cells in human stem cell culture. This advance brings stem cell maintenance a step closer to the goal of animal-free media and culture. If human embryonic stem cells are ever to be used in human transplants, they need to be free of foreign animal factors that would lead to immune rejection. A group led by Ren-He Xu at WiCell Research Institute and James A. Thomson at the University of Wisconsin, Madison, investigated the effect of inhibiting a signaling pathway that encourages human stem cell differentiation: bone morphogenetic protein (BMP) pathway [*Nat. Methods,* published online Feb. 17, http://dx.doi.org/10.1038/nmeth744]. The addition of a BMP inhibitor called noggin, along with basic fibroblast growth factor, replaced the need for both mouse feeder cells and the complex medium they require. Some animal factors are still needed in the culture preparation, Thomson says, but overall, the new medium is a simpler, safer mix.

Imaging chiral molecules on surfaces

Chirality can be used as an intrinsic property for detecting proteins on microarrays without the need for labels. Imaging chirality on surfaces with conventional optical techniques has been challenging, however. John C. Conboy and Matthew A. Kriech at the University of Utah use second harmonic generation (SHG) microscopy to take a direct image of chiral molecules on a surface in a model system [*J. Am. Chem. Soc.,* published online Feb. 8, http://dx.doi.org/10.1021/ja0430649]. Photons strike the sample surface from opposite directions, and the SHG signal from chiral molecules is emitted perpendicular to the surface and can be selectively isolated. The measured signal is directly proportional to the density of chiral molecules on the surface. Conboy is starting to use chiral SHG microscopy to detect antibodies on surfaces. "We don't have to fluorescently label the antibodies," he says. "It opens up a new label-free imaging technique."

Direct O_2 oxidations: New iron chemistry



Iron(III) tetraamido macrocyclic ligand (TAML) complexes developed by Carnegie Mellon University chemistry professor Terry Collins increase the oxidizing power of hydrogen peroxide under mild conditions, making the catalysts useful as substitutes for environmentally unfriendly chlorine- and metal-based industrial oxidations. An international team led by Collins has now shown that TAML complexes can facilitate oxidations using molecular oxygen, a process

the researchers knew was possible but for which they did not have definitive proof [*J. Am. Chem. Soc.*, **127,** 2505 (2005)]. Previously, only iron(II) complexes were known to react this way with O_2. The team reacted solutions of a TAML complex (shown) with O_2 at room temperature to generate an iron(IV) TAML dimer in which the iron atoms are linked by a bridging oxygen atom abstracted from O_2. The dimer catalytically oxidizes alcohols to aldehydes and phosphines to phosphine oxides. The initial TAML complex is regenerated in the process. This new type of iron-oxygen chemistry is important in understanding biological oxidation processes and could further improve industrial oxidations, Collins tells C&EN.

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