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Special Issue: Fourth International Symposium on Bioorganometallic Chemistry (ISBOMC'08)

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Reviews

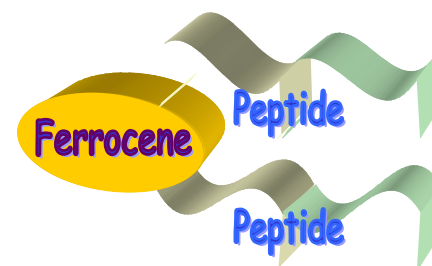
Toshikazu Hirao

J. Organomet. Chem. 694 (2009) 806

Control of chirality-organized structures of ferrocene–dipeptide bioconjugates

A variety of ferrocene–dipeptide bioconjugates have been designed to induce chirality-organized structures in both solid and solution states. The ferrocene serves as a reliable organometallic scaffold for the construction of protein secondary struc-

tures via intramolecular hydrogen bondings, wherein the attached dipeptide strands are regulated in the appropriate dimensions. The configuration and sequence of the amino acids are found to play an important role in the construction of the chirality-organized bio-inspired systems under controlled hydrogen bonding.

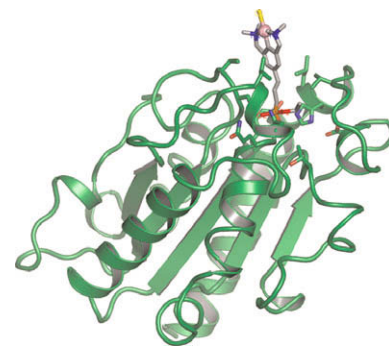


Birgit Wieczorek, Harm P. Dijkstra, Maarten R. Egmond, Robertus J.M. Klein Gebbink, Gerard van Koten

J. Organomet. Chem. 694 (2009) 812

Incorporating ECE–pincer metal complexes as functional building blocks in semi-synthetic metalloenzymes, supramolecular polypeptide hybrids, tamoxifen derivatives, biomarkers and sensors

This account highlights different applications within the field of bioorganometallic chemistry of hybrids involving covalent or non-covalent assemblies of organometallic ECE–pincer building blocks; examples include the amalgamation of pincer metal complexes with anticarcinogenic agents, carbohydrates, polypeptides, and solid supports or lipases.



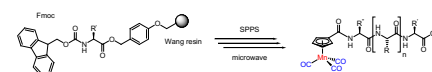
Regular Papers

Harmel W. Peindy N'Dongo, Ingo Ott, Ronald Gust, Ulrich Schatzschneider

J. Organomet. Chem. 694 (2009) 823

Microwave-assisted solid-phase synthesis, cellular uptake, and cytotoxicity studies of cymantrene–peptide bioconjugates

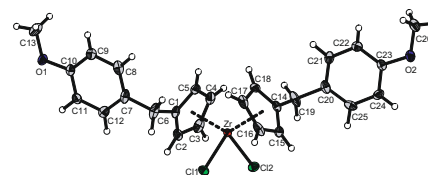
Cymantrene is a robust organometallic biomarker which can be introduced to peptides using a fully automated solid-phase synthesis protocol under microwave irradiation in all steps to give bioconjugates in good yield and purity.



**Denise Wallis, James Claffey,
Brendan Gleeson, Megan Hogan,
Helge Müller-Bunz, Matthias Tacke**
J. Organomet. Chem. 694 (2009) 828

Novel zirconocene anticancer drugs?

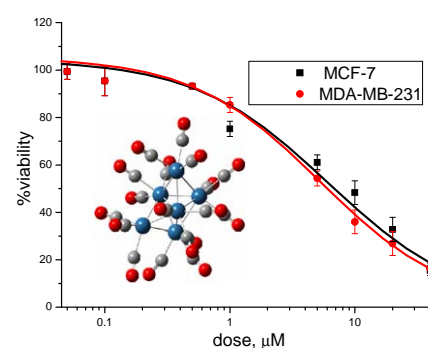
Three benzyl-substituted zirconocenes were synthesised through the hydrido-lithiation reaction of aryl-substituted fulvenes. Within, the syntheses and X-ray structures of the three zirconocene derivatives are reported along with their cytotoxicity tests.



**Kien Voon Kong, Weng Kee Leong,
Lina H.K. Lim**
J. Organomet. Chem. 694 (2009) 834

Induction of apoptosis by hexaosmium carbonyl clusters

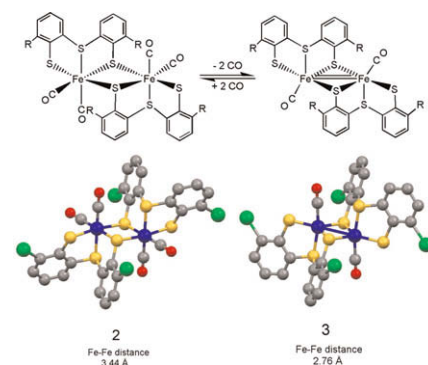
The hexaosmium carbonyl clusters $\text{Os}_6(\text{CO})_{18}$ and $\text{Os}_6(\text{CO})_{16}(\text{NCCH}_3)_2$ were found to induce apoptosis in the ER+ breast carcinoma (MCF-7), ER-breast carcinoma (MDA-MB-231), metastatic colorectal adenocarcinoma (SW620) and hepatocarcinoma (Hepg2) cell lines.



**Inigo Aguirre de Carcer,
D. Michael Heinekey**
J. Organomet. Chem. 694 (2009) 840

Synthesis and structural characterization of sulfur rich iron (II) carbonyl dimers: Facile reversible reaction with carbon monoxide

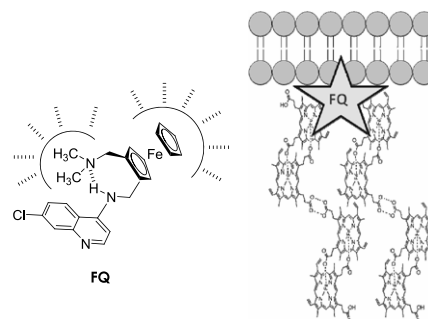
Novel Fe(II) carbonyl complexes are found to undergo facile reversible carbonylation/decabonylation reactions.



**Christophe Biot, Natascha Chavain,
Faustine Dubar, Bruno Pradines,
Xavier Trivelli, Jacques Brocard,
Isabelle Forfar, Daniel Dive**
J. Organomet. Chem. 694 (2009) 845

Structure-activity relationships of 4-N-substituted ferroquine analogues: Time to re-evaluate the mechanism of action of ferroquine

The mechanism of action of FQ was discussed with the process of catalysis-mediated hemozoin formation at the interface between vacuolar content and membrane lipids.

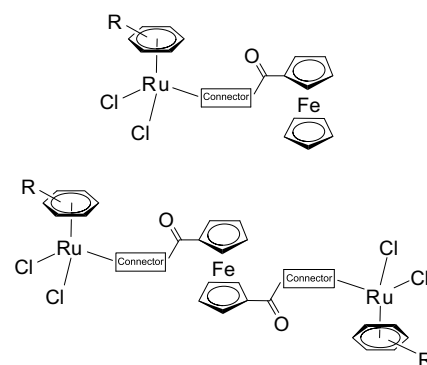


**Mathieu Auzias, Joël Gueniat,
Bruno Therrien, Georg Süss-Fink,
Anna K. Renfrew, Paul J. Dyson**

J. Organomet. Chem. 694 (2009) 855

Arene-ruthenium complexes with ferrocene-derived ligands: Synthesis and characterization of complexes of the type $[\text{Ru}(\eta^6\text{-arene})(\text{NC}_5\text{H}_4\text{CH}_2\text{NHOC-C}_5\text{H}_4\text{FeC}_5\text{H}_5\text{Cl}_2)]$ and $[\text{Ru}(\eta^6\text{-arene})(\text{NC}_3\text{H}_3\text{N}(\text{CH}_2)_2\text{O}_2\text{C-C}_5\text{H}_4\text{FeC}_5\text{H}_5\text{Cl}_2)]$

A series of eight arene-ruthenium complexes containing ferrocene-derived ligands have been synthesized and characterized. The *in vitro* anticancer activities of these complexes have been studied comparatively to the uncoordinated ligands. The complexes exhibit fairly low cytotoxicities in comparison to related ferrocene-derived arene-ruthenium complexes.

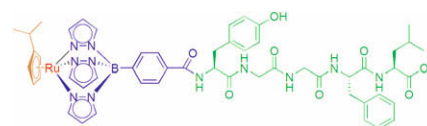


**Johannes Zagermann,
Matthew C. Kuchta, Klaus Merz,
Nils Metzler-Nolte**

J. Organomet. Chem. 694 (2009) 862

Ruthenium-based bioconjugates: Synthesis and X-ray structure of the mixed ligand sandwich compound $\text{RuCp}^{\text{IPr}}(p\text{-(CO}_2\text{H)C}_6\text{H}_4\text{Tp)}$ and labelling of amino acids and the neuropeptide enkephalin

Four mixed ligand sandwich ruthenium complexes with various cyclopentadienyl and tris(pyrazoyl)borate ligands have been synthesized and characterized. $\text{Cp}^{\text{IPr}}\text{Ru}(p\text{-BrC}_6\text{H}_4\text{)Tp}$ has been converted to a complex with a benzoic acid-functionalized-Tp ligand, $\text{Cp}^{\text{IPr}}\text{Ru}(p\text{-(CO}_2\text{H)C}_6\text{H}_4\text{)Tp}$, which has been structurally characterized by X-ray diffraction and further has been shown to undergo coupling to biomolecules both in solution and in solid phase peptide synthesis, providing amino acid and peptide bioconjugates.

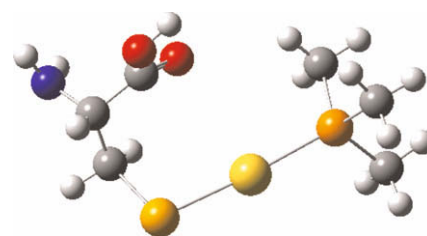


James A.S. Howell

J. Organomet. Chem. 694 (2009) 868

DFT investigation of the interaction between gold(I) complexes and the active site of thioredoxin reductase

DFT methods have been used to investigate the bonding of gold(I) to the active site of thioredoxin reductase.

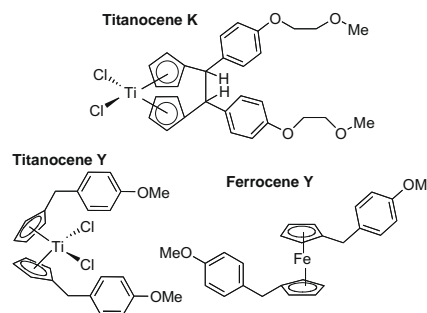


**Anne Vessières, Marie-Aude Plamont,
Claude Cabestaing, James Claffey,
Sandra Dieckmann, Megan Hogan,
Helge Müller-Bunz, Katja Strohfelddt,
Matthias Tacke**

J. Organomet. Chem. 694 (2009) 874

Proliferative and anti-proliferative effects of titanium- and iron-based metallocene anti-cancer drugs

On hormone dependent breast cancer cells, Titanocene K is highly proliferative at low concentration (0.5 μM) while Titanocene Y has almost no effect at 10 μM but exhibits a significant dose dependent cytotoxic effect when incubated with serum albumin. Ferrocene Y shows only a modest anti-proliferative effect on these cells.

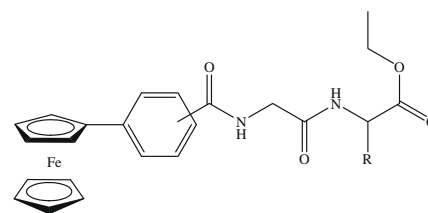


Alan J. Corry, Norma O'Donovan, Áine Mooney, Dermot O'Sullivan, Dilip K. Rai, Peter T.M. Kenny

J. Organomet. Chem. 694 (2009) 880

Synthesis, structural characterization, *in vitro* anti-proliferative effect and cell cycle analysis of *N*-(ferrocenyl)benzoyl dipeptide esters

Ferrocenyl benzoyl dipeptide esters **2–10** were prepared by conventional peptide chemistry using the EDC/HOBT protocol. Compounds **3**, **6** and **9** exhibited cytotoxic effects versus H1299 lung cancer cells. Cell cycle analysis of *N*-(*ortho*-ferrocenyl)-benzoyl-glycine-*L*-alanine ethyl ester **13** suggests a block in the G2/M phase of the cell cycle.

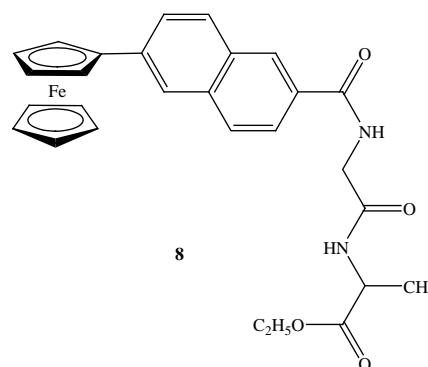


Áine Mooney, Alan J. Corry, Dermot O'Sullivan, Dilip K. Rai, Peter T.M. Kenny

J. Organomet. Chem. 694 (2009) 886

The synthesis, structural characterization and *in vitro* anti-cancer activity of novel *N*-(3-ferrocenyl-2-naphthoyl) dipeptide ethyl esters and novel *N*-(6-ferrocenyl-2-naphthoyl) dipeptide ethyl esters

N-(3-ferrocenyl-2-naphthoyl) dipeptide esters (**5–7**) and *N*-(6-ferrocenyl-2-naphthoyl) dipeptide esters (**8–10**) were prepared by conventional peptide chemistry using the EDC/HOBT protocol. Compounds **5–10** exhibited cytotoxic effects on the human lung carcinoma cell line H1299; the most active derivative being *N*-(6-ferrocenyl-2-naphthoyl)-glycine-*L*-alanine ethyl ester **8** ($IC_{50} = 1.3 \pm 0.1 \mu M$).



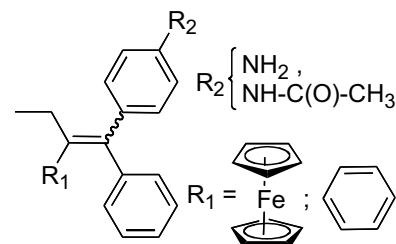
Pascal Pigeon, Siden Top, Ouardia Zekri, Elizabeth A. Hillard, Anne Vessières, Marie-Aude Plamont, Olivier Buriez, Eric Labbé, Michel Huché, Sultana Boutamine, Christian Amatore, Gérard Jaouen

J. Organomet. Chem. 694 (2009) 895

The replacement of a phenol group by an aniline or acetanilide group enhances the cytotoxicity of 2-ferrocenyl-1,1-diphenyl-

but-1-ene compounds against breast cancer cells

The ferrocenyl and phenyl aniline and anilide derivatives have been synthesized and characterized. Both ferrocenyl complexes show a strong antiproliferative effect on ER-breast cancer cells ($IC_{50} = 0.8$ and $0.65 \mu M$) while their corresponding organic molecules have no effect. Interestingly this effect is stronger than that of the corresponding phenol.

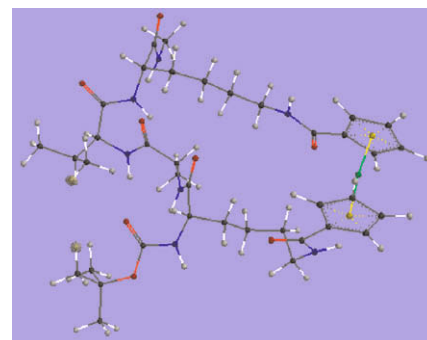


Timothy P. Curran, Emma L. Handy

J. Organomet. Chem. 694 (2009) 902

A 3_{10} -helix single turn enforced by crosslinking of lysines with 1,1'-ferrocenedicarboxylic acid

Reaction of Boc-Lys-Ala-Val-Lys-NHMe with 1,1'-ferrocenedicarboxylic acid chloride yields a cyclic species in which the lysine side chains are crosslinked and the peptide adopts a single turn of a 3_{10} -helix.

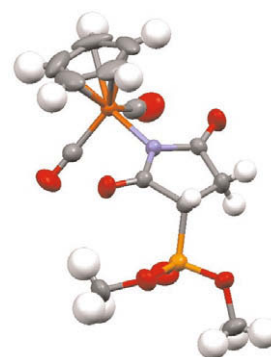


**Bogna Rudolf, Michèle Salmain,
Marcin Palusiak, Janusz Zakrzewski**

J. Organomet. Chem. 694 (2009) 908

The phospha-Michael addition of dimethyl- and diphenylphosphites to the η^1 -*N*-maleimidato ligand: Inhibition of serine hydrolases by half-sandwich metallocarbonyl azaphosphonates

Dialkyl- and diphenyl phosphites react with the $(\eta^5\text{-C}_5\text{H}_5)\text{M}(\text{CO})_x(\eta^1\text{-N-maleimidato})$ ($\text{M} = \text{Fe}, \text{Mo}; x = 2 \text{ or } 3$) complexes giving products of the phospha-Michael addition to the η^1 -*N*-maleimidato ligand. The synthesized metallocarbonyl azaphosphonates and the corresponding iron phosphonic acid act as inhibitors of certain serine hydrolases (AChE and BChE). The inhibition mechanism depends strongly on the enzyme and the structure of the inhibitor.

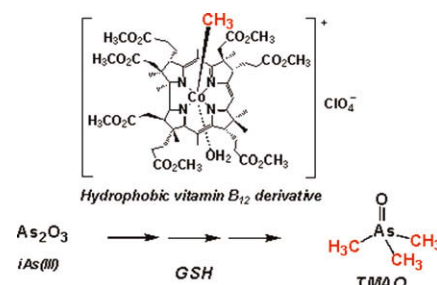


**Koichiro Nakamura, Yoshio Hisaeda,
Ling Pan, Hiroshi Yamauchi**

J. Organomet. Chem. 694 (2009) 916

Methyl transfer from a hydrophobic vitamin B₁₂ derivative to arsenic trioxide

Hydrophobic vitamin B₁₂ derivative as methyl donor for the methylation of arsenic trioxide and glutathione gave a >95% rate of methylation at 37 °C and pH 7.0, products included monomethylarsonous acid (MMA), dimethylarsinic acid (DMA) and trimethylarsine oxide, while for methylcobalamin, the methylation rate was about 20% and only MMA and DMA were formed.

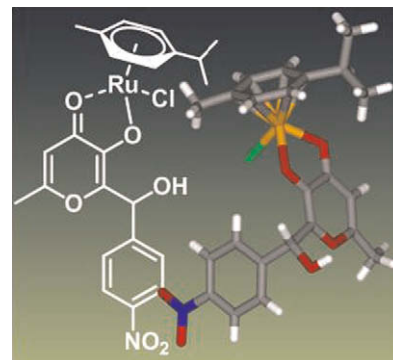


**Wolfgang Kandioller,
Christian G. Hartinger, Alexey A. Nazarov,
Johanna Kasser, Roland John,
Michael A. Jakupec, Vladimir B. Arion,
Paul J. Dyson, Bernhard K. Keppler**

J. Organomet. Chem. 694 (2009) 922

Tuning the anticancer activity of maltol-derived ruthenium complexes by derivatization of the 3-hydroxy-4-pyrone moiety

Organometallic ruthenium(II) complexes based on maltol-derived ligands were synthesized and their hydrolysis behavior, reaction to the DNA model 5'-GMP, and anticancer activity against human tumor cell lines was tested. Promising anticancer activity was observed, with the lipophilicity of the compounds appearing to be the determining parameter.

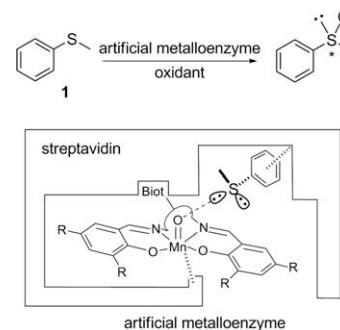


A. Pordea, D. Mathis, T.R. Ward

J. Organomet. Chem. 694 (2009) 930

Incorporation of biotinylated manganese-salen complexes into streptavidin: New artificial metalloenzymes for enantioselective sulfoxidation

Incorporation of achiral biotinylated manganese-salen complexes into streptavidin yields artificial metalloenzymes for aqueous sulfoxidation using hydrogen peroxide.

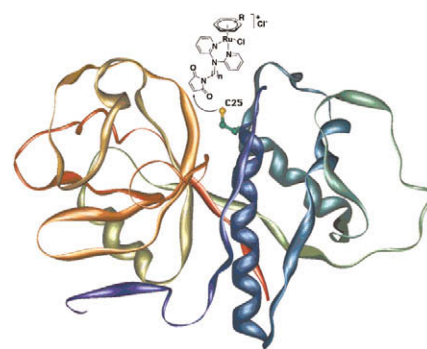


Pierre Haquette, Blaise Dumat, Barisa Talbi, Shararé Arbabi, Jean-Luc Renaud, Gérard Jaouen, Michèle Salmain

J. Organomet. Chem. 694 (2009) 937

Synthesis of *N*-functionalized 2,2'-dipyridylamine ligands, complexation to ruthenium (II) and anchoring of complexes to papain from papaya latex

2,2'-Dipyridylamine (dpa) derivatives carrying a thiol-targeted maleimide group were synthesized. Reaction with $[(\eta^6\text{-arene})\text{RuCl}_2]_2$ (arene = benzene or *p*-cymene) yielded the $[(\eta^6\text{-arene})\text{Ru}(\text{dpa})\text{Cl}]^+$ complexes where the dipyridylamine derivatives were coordinated as bidentate ligands. Enzymatic studies showed that these derivatives were able to inactivate papain by *S*-alkylation of its active site cysteine.

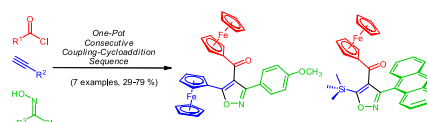


Benjamin Willy, Walter Frank, Frank Rominger, Thomas J.J. Müller

J. Organomet. Chem. 694 (2009) 942

One-pot three-component synthesis, structure and redox properties of ferrocenyl isoxazoles

A consecutive coupling-cycloaddition sequence of acid chlorides, terminal alkynes, and *in situ* generated nitrile oxides furnishes ferrocenyl substituted redox active isoxazoles in moderate to good yields. Redox potentials of all representatives are strongly effected by the electronic nature of the bridging isoxazoloyl moiety.

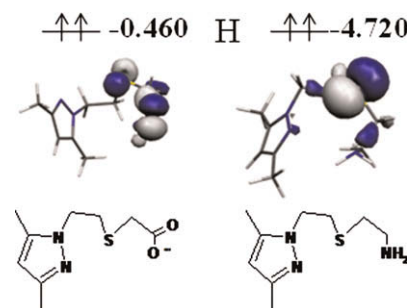


Carolina Moura, Célia Fernandes, Lurdes Gano, António Paulo, Isabel C. Santos, Isabel Santos, Maria José Calhorda

J. Organomet. Chem. 694 (2009) 950

Influence of the ligand donor atoms on the *in vitro* stability of rhenium(I) and technetium (I)-99m complexes with pyrazole-containing chelators: Experimental and DFT studies

The pyrazolyl-containing ligands 3,5-Me₂pz(CH₂)₂-S(CH₂)₂COOH (L¹H) and 3,5-Me₂pz(CH₂)₂O(CH₂)₂COOH (L²H) form well defined tricarbonyl complexes of the type *fac*-[M(κ^3 -L)(CO)₃] (L = L¹, M = Re (1), ^{99m}Tc (1a); L = L², M = Re (2), ^{99m}Tc (2a)). In these complexes the chelators act as monoanionic and tridentate through N,S,O (1/1a) and N₂O (2/2a) donor atom sets. Both compounds present a relatively similar biological profile in mice, but the introduction of the thioether group in **1a** enhanced its *in vitro* reactivity towards cysteine and histidine. DFT calculations performed for the neutral **1/1a** and **2/2a**, as well as for other related cationic complexes anchored by neutral ligands, have shown that the anionic ligands are softer than the neutral ones and make stronger bonds with the M(CO)₃ fragments. For both families the replacement of nitrogen by a sulfur donor atom leads to slightly less stable complexes ($\Delta E \sim 4\text{--}10$ kcal/mol).

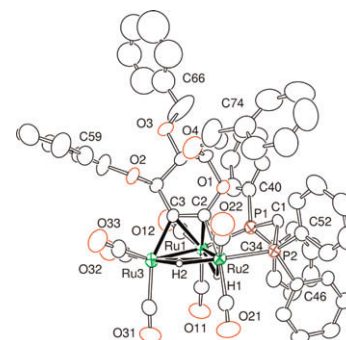


V.D. Reddy, Divya Dayal, Stephen C. Cosenza, M.V. Ramana Reddy, William C. Pearl Jr., Richard D. Adams

J. Organomet. Chem. 694 (2009) 959

Glycal-ruthenium carbonyl clusters: Syntheses, characterization, and anticancer activity

Ruthenium carbonyl cluster complexes containing a dehydrogenated form (L-2H) of 3,4,6-tri-*O*-benzyl- β -galactal (L) as a chiral ligand have been prepared and the complex Ru₃(μ -H)₂(CO)₇(L-2H)(dppm) (**2**) was structurally characterized. These complexes show promising anticancer activity against six types of human cancer cell lines.

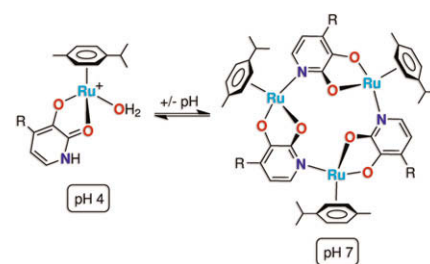


**Wee Han Ang, Zacharias Grote,
Rosario Scopelliti,
Lucienne Juillerat-Jeanneret,
Kay Severin, Paul J. Dyson**

J. Organomet. Chem. 694 (2009) 968

Organometallic complexes that interconvert between trimeric and monomeric structures as a function of pH and their effect on human cancer and fibroblast cells

The notion that pH could be used to activate trimeric ruthenium(II)-arene compounds, giving more reactive and cytotoxic mononuclear species, is explored using tumorigenic and non-tumorigenic cell lines.

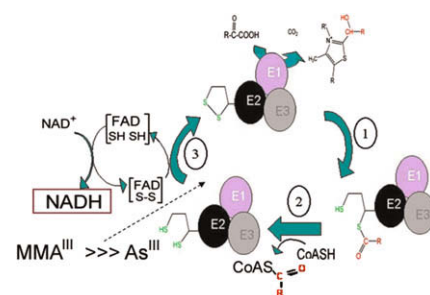


**Erik R. Bergquist, Robert J. Fischer,
Kent D. Sugden, Brooke D. Martin**

J. Organomet. Chem. 694 (2009) 973

Inhibition by methylated organoarsenicals of the respiratory 2-oxo-acid dehydrogenases

Only reduced arsenic species were able to inhibit the enzymatic action of the pyruvate and α -ketoglutarate dehydrogenase complexes and only under condition that poised the enzyme complex in a catalytic state that contained reduced lipoic acid groups. Monomethylarsenite was by far the most potent compound toward enzyme inhibition.

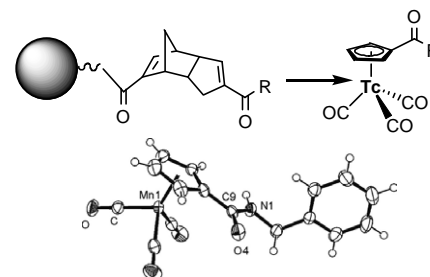


**H.W. Peindy N'Dongo, Y. Liu, D. Can,
P. Schmutz, B. Spingler, R. Alberto**

J. Organomet. Chem. 694 (2009) 981

Aqueous syntheses of [(Cp-R)M(CO)₃] type complexes (Cp = cyclopentadienyl, M = Mn, ^{99m}Tc, Re) with bioactive functionalities

Diels–Alder products of cyclopentadiene derivatives [(HCp-R)₂] can be used to synthesize [(Cp-R)^{99m}Tc(CO)₃] complexes directly from water. If [(HCp-R)₂] is coupled to a solid phase resin, the same products are formed. This opens the possibility of preparing no carrier added radiopharmaceuticals with cyclopentadienyl as a ligand.



**Ayesha Sharmin, Reuben C. Darlington,
Kenneth I. Hardcastle, Mauro Ravera,
Edward Rosenberg, J.B. Alexander Ross**

J. Organomet. Chem. 694 (2009) 988

Tuning photophysical properties with ancillary ligands in Ru(II) mono-diimine complexes

The series of complexes [XRu(CO)(L-L)(L')₂]⁺ [PF₆]⁻ (X = H, TFA, Cl; L-L = 2,2'-bipyridyl, 1,10-phenanthroline, 5-amino-1,10-phenanthroline and 4,4'-dicarboxylic-2,2'-bipyridyl; L' = 2PPh₃, Ph₂-PC₂H₄PPh₂) have been synthesized from the starting complex K⁺ [Ru(CO)₃(TFA)₃] (TFA = CF₃CO₂). The complexes exhibit a broad range of useful photophysical properties, very complex electrochemistry and a tendency to lose the TFA ligand with conversion to the corresponding hydride or chloride.

