

Editorial

## Frontiers in Gold Chemistry

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**Abstract:** Basic chemistry of gold tells us that it can bond to sulfur, phosphorous, nitrogen, and oxygen donor ligands. The *Frontiers in Gold Chemistry* Special Issue covers gold complexes bonded to the different donors and their fascinating applications. This issue covers both basic chemistry studies of gold complexes and their contemporary applications in medicine, materials chemistry, and optical sensors. There is a strong belief that aurophilicity plays a major role in the unending applications of gold.

**Keywords:** polyoxometalates; heteronuclear complexes; rheumatoid arthritis; gold(I) thiolate–disulfide exchange

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### 1. Background

We stated in the call for papers that the chemistry of the “Sleeping Beauty” gold has attracted interest in basic chemistry and applications [1–6]. This turned out to be true and the papers and reviews submitted to *Frontiers in Gold Chemistry* covered applications in volatile organic compound sensors, liquid crystal displays, medicine, and biological reactions. Aurophilic bonding, which reproduces the attractive forces between the gold atoms, has imparted unique properties in gold chemistry and probably is the foundation of the unique electronic and optoelectronic properties of gold. This has led to interesting papers submitted to this Special Issue on gold–thione and heterometallic complexes. As a chemical catalyst, gold plays an important role in new environmental applications, such as pollution control of mercury emissions. Gold is emerging in a new application:

*Gold is Going Forensic!* The application of gold in this interesting area of research represents a major step forward in gold chemistry [7].

The present Special Issue attracted research groups from several countries. International collaboration was visible in some manuscripts as well.

## 2. The Present Issue

This Special Issue has attracted three reviews and five manuscripts. The real world applications presented in the published issue highlight the applications of gold in almost all fields. It is not an exaggeration to state: *Chemistry is Going Gold!* The review by Manuel Bardají deals with the new results obtained this century on gold liquid crystals [8]. This research is relevant to applications in light emitting diodes, information storage and sensors [9,10]. Calamitic and discotic mesogens have been reported, as well as chiral liquid crystals. Hydrogen bonding has been utilized to obtain gold mesogens. Some of them exhibit additional properties such as color, luminescence in the solid state and in solution, and chirality.

Gold metallochelators is an emerging area of research [11]. Auophilicity is believed to be a major factor in inducing gelation in gold(I) complexes. In a review by João Carlos Lima and Laura Rodríguez an overview of gold metallochelators is presented. They have also discussed the potential applications of this amazing class of supramolecular assemblies.

The third review was submitted by Mohamed and collaborators on gold drugs [12]. In their review they discussed the therapeutic mechanism of arthritic gold drugs and their modification in the presence of stomach hydrochloric acid, in the joints, and in the presence of mild and strong oxidizing agents. Rheumatoid arthritis, cancer, heart diseases and recently AIDS have all been targeted with gold nanoparticles therapy.

Studies involving gold complexes of nitrogen donor ligands range from classical coordination chemistry to the developing field of bioinorganic chemistry [13]. Many classes of these coordination compounds that exhibit various structures have been reported, which has given rise to advances in several fundamental and applied research aspects. The gold(II) amidinate complexes are the first gold(II) species isolated with nitrogen ligands [14]. The complexes are stable at room temperature. To probe the reactivity of gold–nitrogen bonds, Justin Walensky and his research group examined the insertion chemistry of gold(I) amidinate complexes with carbon disulfide as well as oxidation with cesium tribromide [15]. They also examined the reactivity of CS<sub>2</sub> and CsBr<sub>3</sub> with the previously reported dinuclear gold(I) amidinate complex. Carbon disulfide insertion produces a polymeric product which shows a dinuclear core with linking auophilic interactions. The gold(II,II) product is obtained when CsBr<sub>3</sub> is reacted with the gold(I) amidinate complex.

Vito Lippolis from Università degli Studi di Cagliari, Spain, and M. Concepción Gimeno from Universidad de Zaragoza, Spain, synthesized dinuclear gold(I) complexes which were isolated and characterized using X-ray crystallography from the reaction of a dithione ligand with gold complexes [16]. They studied the coordination properties of thione ligands toward gold(I) and gold(III) complexes. The crystal structures show that the gold centers coordinate to the sulfur atoms of the thione groups. According to the authors, no single gold complex with this type of ligand has been obtained to date.

The growing interest in the synthesis of polyoxometalates (POM) is due their wide applications in catalysis, medicine, and materials science. Novel phosphanegold(I) cluster cations combined with polyoxometalate (POM) anions were synthesized via POM-mediated clusterization by Kenji Nomiya and collaborators from Japan [17]. The research groups showed that the formation of the these gold(I) cluster cations was strongly dependent upon the charge density and acidity of the POMs as well as other factors.

The solicited manuscript by José M. López-de-Luzuriaga and his collaborators describes direct applications in blue emitters [18]. Homonuclear and heteronuclear complexes which exhibit metallophilicity are widely studied as vapochromic sensors for volatile organic compounds (VOCs). The heteronuclear gold(I)–mercury(II) complex was synthesized and structurally characterized and shows an unusual blue luminescent emission in the solid state. Theoretical calculations suggest that the origin of the emission arises from ligand to metal–metal charge transfer transition.

The Bruces, Alice Bruce and Mitchell Bruce, from the University of Maine, USA [19], studied the thiol–disulfide exchange reactions which are essential for a number of biochemical transformations. They investigated the mechanism of gold(I) thiolate–disulfide exchange and the conditions which lead to the formation of the competing phosphine oxide. Spectroscopic experiments are consistent with an intermediate in which the disulfide and phosphine gold(I) thiolate are in close proximity. It was established that phosphine oxide formation happens on a longer time scale than thiolate–disulfide exchange.

It has been a great honor and pleasure to edit this Special Issue on Frontiers in Gold Chemistry. I must thank all who helped me to accomplish this task in the editorial office and in particular Ms. Mary Fan.

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