Section 1. Summary of results

The project PdAuCHAryl was designed to provide a new method for the synthesis of biaryls, a type of chemical compounds of great importance in a wide range of applications including pharmaceutical and agrochemical industries, materials science and optoelectronics, related compounds being used as fundamental components in light-emitting diodes (a research area that has been recently recognised with the award of the Nobel Prize in physics to three of its main contributors).

Our proposed strategy focused on developing a method that would be more simple, efficient and environmentally friendly (i.e. with reduced use of energy and resources and less waste products) than currently available technologies. For this, we planned to build up on previous results from our group and others on the reactivity between gold compounds and aromatic compounds, which we hypothesised would allow for gold to catalyse the direct coupling of two arenes to provide a biaryl (Figure 1).

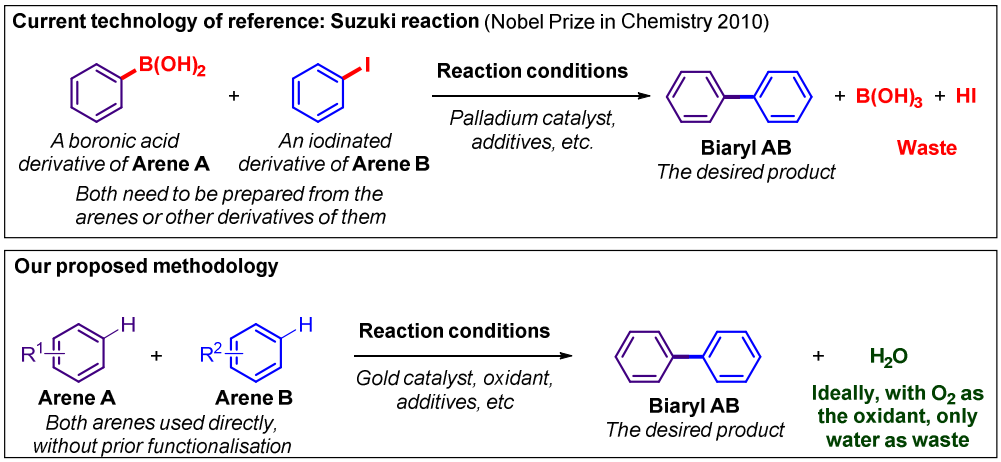

Figure 1

During the first year of the project, we were able to develop and report a proof-of-concept study showing the formation of biaryls from the reaction of aromatic compounds with arylgold compouns (Figure 2a). This study served to prove the feasibility of our approach and encouraged us to continue for the development of a reaction which would use gold only as a catalyst and couple both arenes directly without any previous functionalisation.

During the second year we have made significant progress towards achieving such objective. Through extensive experimentation we have identified conditions that allow the coupling of two different arenes with minimal or no formation of undesired by-products (Figure 2b). Work directed to extending the range of starting materials to which it is applicable and to finish optimising the efficiency of the method is ongoing and we expect to be able to publish it soon.

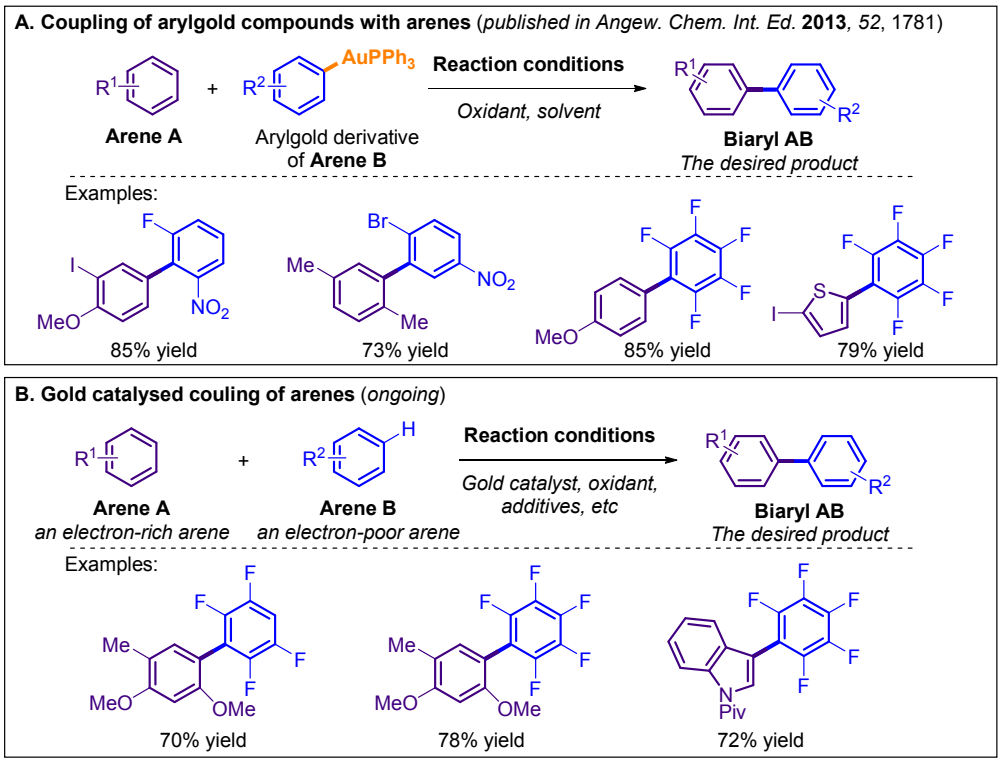

Figure 2

The methodology developed, once the optimisation is finished, will open a new route for the preparation of biaryls in a more efficient and simple manner than currently available methods. This is expected to have immediate academic impact by facilitating access to chemical compounds needed for research in other areas, such as medicinal chemistry and molecular biology, materials science, etc. In a longer term, it could be applied in the preparation of industrially useful compounds such as drugs or agrochemicals. The use of this methodology in industrial applications would reduce the number of operations necessary for the preparation of a target compound, thus reducing the cost and favouring the sustainability of the overall process.