Supporting Information

Leifert et al. 10.1073/pnas.1220143110

SI Text

Effect of Gold Nanoparticles on Electrodes

To rule out any electrochemical effects of the gold nanoparticles (AuNPs) with the Ag/AgCl-pellet electrode it was replaced by an electrode made of a chlorinated Ag wire embedded in 3 M KCl containing agarose. It was confirmed in control experiments that application of AuNPs had no effect on both types of electrodes: It was tested whether the presence of AuNPs leads to a shift of the offset value of the patch-clamp electrodes. For this, the offset values were detected over a period of 10 min during perfusion of AuNPs comprising a 55-gold-atom cluster core with a diameter of 1.4 nm and a shell consisting of 12 sodium (3-diphenylphosphino) benzenesulfonic acid (TPPMS) molecules (Au1.4MS). No changes could be observed. Therefore, we can exclude this possible technical artifact.

Influence on Membrane Potential

The incubation of HEK 293 cells with Au1.4MS increases the resting membrane potential V_{rest}. When untransfected HEK cells were treated with Au1.4MS, no effect was detectable. In the latter case, V_{rest} is determined by chloride conductivity; in transfected cells, it mainly depends on the K^+ flow. When Au1.4MS blocks human ether-á-go-go-Related gene (*hERG*), the K^+ flow is inhibited, and therefore the fraction/portion of V_{rest} that is determined by chloride increases and the membrane potential increases.

A control experiment with quinidine, a typical hERG blocker, revealed the same effect. This shows that the effects of Au1.4MS on the membrane potential are mainly caused by the direct inhibition of the hERG channel. However, subtle effects on the membrane caused by Au1.4MS are possible. Patch clamp is not the method of choice to address this topic, which was outside the scope of this study.

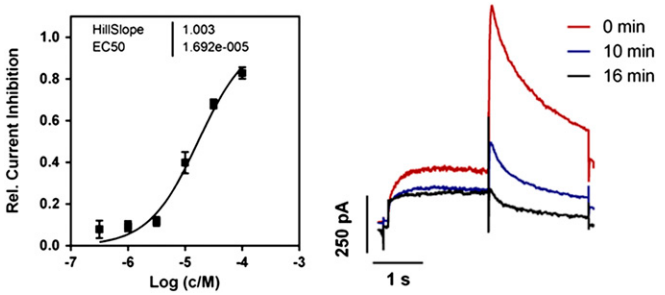

Fig. S1. Determination of half-maximal blocking concentration. (*Left*) Concentration-response relation for the inhibition of the hERG tail current amplitude by Au1.4MS. Extracellular application of Au1.4MS led to a concentration-dependent reduction of the hERG tail current amplitude with a half-maximal blocking concentration of 16.9 μM (n = 3–9 independent recordings per concentration). (*Right*) Representative hERG whole-cell currents after 0 min, 10 min, and 16 min extracellular application of 100 μM Au1.4 MS.

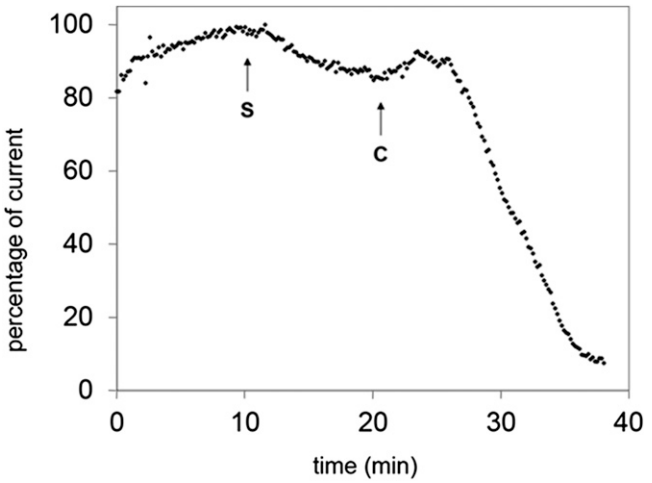

Fig. S2. Pretreatment of cell with TPPMS and subsequent Au1.4MS incubation. A cell was pretreated with 50 μM TPPMS for 10 min (starting at S) before 20 μM Au1.4MS (without additional TPPMS) was applied (starting at C). In this case, the current inhibition was not prevented.

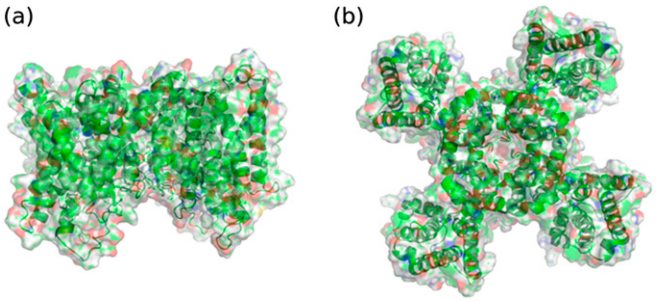

Fig. S3. Homology model for the hERG channel, based on the crystal structure of the mammalian voltage-dependent Shaker family K+ channel [Protein Data Bank (PDB) ID: 2A79]. (*A*) side view; (*B*) top view.

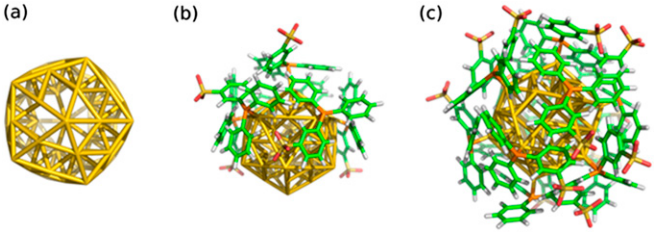

Fig. S4. Input files for the simulations. (*A*) AuNP with 55 gold atoms (Au1.4) without ligands. (*B* and *C*) Au1.4 with 6 (*B*) [Au1.4MS(6)] and 12 (*C*) [Au1.4MS(12)] TPPMS ligands.

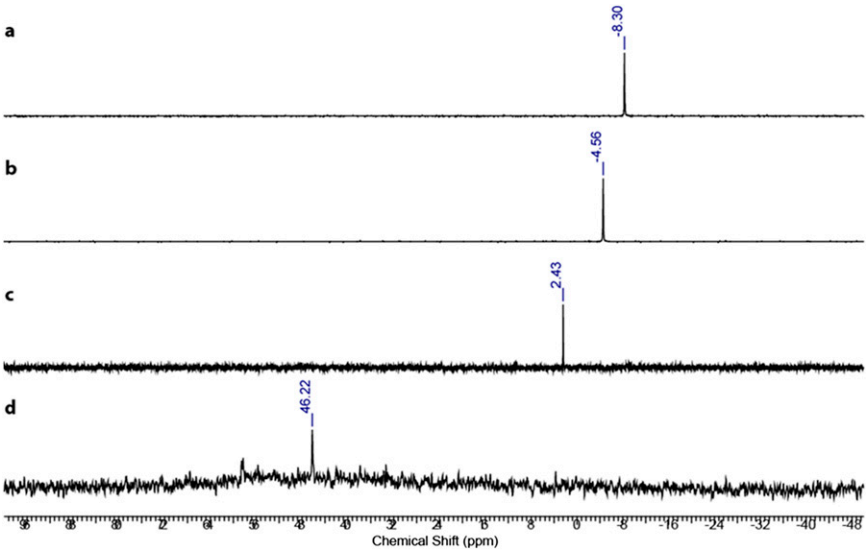

Fig. S5. ^{31}P-NMR measurements of Au1.4MS and FCS. Shown are ^{31}P-NMR measurements of (*A*) TPPMS in water, (*B*) TPPMS + 10% FCS, (*C*) Au1.4MS + 10% FCS, and (*D*) Au1.4MS.