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Chemical sensors (or chemosensors) are the systems which transform chemical information into a signal – thus allowing the detection of chemical species. There is a big practical interest in making sensors for biologically and environmentally important analytes. In our work we addressed this issue developing metal-based chemosensors for amino acids, peptides, and nucleotides – important bioanalytes. Most of chemical sensors described up to date, suffer from 2 main disadvantages: a) they are not able to function under physiological conditions – in purely aqueous solution and b) they require substantial efforts to synthesize them. To overcome the first problem, we employed an organometallic rhodium complex, which allowed detecting bioanalytes down to micro/millimolar concentrations. To cope with the second one, we constructed our sensors by the self-assembly of a commercially available dyes with the rhodium complex. In spite of this simplicity, remarkable selectivity *and* sensitivity were achieved in detecting peptides, amino acids, and nucleotides.