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Preface

Sensing typically refers to the continuous monitoring of the activity of a chemical species (the analyte) in a given matrix (air, blood, a tissue, waste effluents, drinking water, a glass vessel in the lab etc.). Whatever the nature of sensor is, whether macroscopic (e.g. a solid 'finger' dipped in a liquid to analyse) or microscopic (e.g. a molecule seeking for a particular substrate in solution), sensing in most cases relies on an interaction occurring at the molecular level: the binding of the analyte to a molecular fragment called receptor: this process is defined by biologists and chemists as 'recognition'. The recognition process has to be fast, reversible and characterised by a moderate energy gain. All the above mentioned features are typical of the metal–ligand interaction and it is not by chance that a variety of currently used sensors operate through a mechanism which involves coordinative binding.

However, sensing is not simply recognition, but requires that the recognition event is signalled to the outside by the drastic change of a given property, which should be visually and/or instrumentally detectable. Among the varying envisaged properties (the shift of an NMR line, the displacement of a polarographic/voltammetric wave, the appearance–disappearance of an absorption band in the UV–vis region etc.), luminescence seems the most convenient signal transduction mechanism for sensing applications, due to the very high sensitivity of its detection technique. Actually, a number of luminescent sensors have been developed during the last decade for a variety of applications, which include cell biology investigations, medical diagnosis, environmental analysis, food quality control. Moreover, the increasing communication between end-users and synthetic chemists is expected to produce in the next few years the development of chemical sensors for any kind of analyte, either biotic or abiotic.

From the point of view of coordination chemistry, it is worth noting that a breakthrough in fluorescent sensing was observed in the early 1980s, when Roger Y. Tsien developed a not too complex, but powerful molecule suitable for the real time and real space determination of the activity of Ca^{2+} within living cell by using fluorescence microscopy [1]. The sensing system was obtained by appending an appropriate fluorophore to the framework of EGTA, a multidentate ligand synthesised in the 1950s by Charles Reilley, along the line developed by Gerold Schwarzenbach, one of the founders of coordination chemistry in solution [2]. One

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hundred years of coordination chemistry have produced thousands and thousands of receptors (metal free ligands and coordinatively unsaturated metal complexes) suitable for the specific binding and recognition of any kind of substrate, either ionic or neutral. They only wait to be engineered (e.g. linked to a light-emitting fragment) and to act as luminescent sensors for a given molecule or ion of prominent interest in environmental chemistry, biology, medical analysis and diagnostics.

The above considerations account for the preparation of the present volume of *Coordination Chemistry Reviews* specifically devoted to 'Luminescent Sensors', which consist of eight contributions from distinguished scientists active in the field of the design of luminescent molecular sensors. Each article mainly reflects the experience and achievements of each author, but it has been deliberately written in a plain and not too specialistic style: in this sense, the volume can hopefully represent an introduction and an encouragement to coordination chemists to enter the fascinating and promising area of luminescent sensing.

References

[1] R.Y. Tsien, Biochemistry 19 (1980) 2396.
[2] R. Schmidt, C. Reilley, Anal. Chem. 29 (1957) 264.

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