



Sensor targets

Cite this: *Chem. Soc. Rev.*, 2015, **44**, 4176

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DOI: 10.1039/c5cs90058a

www.rsc.org/chemsocrev

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We are delighted to write these editorials on what has been a very exciting project involving world leading experts on the development of sensors and imaging agents for these two themed issues on sensor targets and imaging agents. Through the coordination and editing of these two issues we were able to take advantage of each other's extensive knowledge in the areas of sensing and imaging.^{1–10}

The choice of who to invite to contribute to the issues was an enjoyable one and included established and up and coming researchers in the overlapping areas of sensing and imaging. We were delighted by the overwhelming and positive response from invitees and their willingness to contribute cutting edge highlight articles, tutorial reviews and critical reviews to *Chemical Society Reviews*. *Chemical Society Reviews* is



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Silva MRIA and undertook a postdoctoral fellowship with Professor David Parker FRS in Durham University from 1996 to 1998. He was appointed to Trinity College Dublin in September 1998. He has held visiting professorships in Italy, France, Australia and New Zealand, having been an Erskin Fellow at University of Canterbury, NZ in 2009. He was awarded the Royal Society of Chemistry Bob Hay Award (Lecture) in 2008. In 2014 he was awarded The Institute of Chemistry of Ireland (ICI) Annual Award for Chemistry (Eva Philbin Lecture).

a premier journal for critical, tutorial and highlight research articles. Therefore, while we invited contributions from researchers who we felt would enhance the journal, the final selection of manuscripts needed to pass the strict refereeing criteria. During this process, some of the reviews we would have liked to include in these themed issues on sensor targets and imaging agents unfortunately didn't make it through the peer review process. However, we are confident and anticipate that those articles will soon be published in other review formats. In summary, as readers you can be assured that the articles contained in these two compilations are of the highest quality and have been rigorously and fairly evaluated by *Chemical Society Reviews* prior to publication. The final compilations consist of diverse selections of articles, which we are confident will encourage new researchers and established researchers working on the development of new sensors and imaging agents to achieve even more outstanding results and fill the remaining blanks in the sensing and imaging areas.

For the sensor issue, 18 articles have been published in diverse areas of sensing from A (anion) to Z (zinc).

In their highlight article, Lee, Kim and Sessler (DOI: 10.1039/C4CS00280F) demonstrate the importance of ratiometric sensors for the detection of cations, anions and biomolecules; the aim of the non-comprehensive overview being to encourage and foster new research towards innovative

sensing methods for toxic substances and essential cellular components, associated with various human diseases.

The basic principles used in the design of aggregation-induced emission (AIE) fluorescent turn-on biosensors are discussed by Tang and co-workers (DOI: 10.1039/C4CS00325J) in a tutorial review. The review provides insight into the mechanisms of AIE-based biosensors and representative example carbohydrate, lipid, amino acid, protein, enzyme and nucleic acid based systems are discussed.

The importance of transition metals in many biological processes has led to the development of sensors for biological research and disease related diagnostic applications. Fan, Peng and co-workers (DOI: 10.1039/C4CS00285G) cover sensors for the detection of first-row d-block metals Cr, Mn, Fe, Co and Ni. The review highlights the need for sensors for Sc, Ti and V, as well as the need to develop improved sensors for Cr, Mn, Fe, Co and Ni.

Wu and Zhu's highlight article (DOI: 10.1039/C4CS00152D) outlines methods used to develop stable fluorophores for biological and biomedical imaging applications. The methods include encapsulation, nanoparticle doping, and the structural modification of fluorophores. Using these techniques, stable fluorescence systems have been developed. The toxicity of such nanoparticles is the last obstacle to overcome prior to their

acceptance as practical *in vivo* imaging agents.

In their tutorial review, Silvi and Credi (DOI: 10.1039/C4CS00400K) describe how semiconductor quantum dots (QDs) can be used as luminescent sensors. They discuss the preparation of sensors capable of interfacing with guests using covalently and non-covalently appended receptors. While QDs have appropriate physical properties and excellent photostability, their widespread use is hampered by concerns over their toxicity.

Rotello and co-workers (DOI: 10.1039/C4CS00387J) have prepared a tutorial review on cell-surface sensing using metallic nanoparticles (NPs). They describe the construction of NPs using different recognition elements to produce specific or selective sensors for target analytes. Sensing using NPs is achieved using physicochemical properties such as fluorescence quenching or enhancement, surface enhanced Raman scattering and electrochemical activity.

In their highlight article, Yeung and Yam (DOI: 10.1039/C4CS00391H) focus discussions on host-guest chemistry, supramolecular chemistry, and reaction-based mechanisms for luminescent cation detection. Included are a diverse range of organic and organometallic architectures that guide the design of such indicators.

Group I and II metal ions are among the most important inorganic species in the periodic table of life. In particular, blood plasma levels of H^+ , Na^+ , K^+ and Ca^{2+} are indicators of several possible disease states. Callan and co-workers (DOI: 10.1039/C4CS00365A) review advances in the luminescent detection of these essential cations in biology.

Silver and gold are noble metals of monetary value that have been utilized extensively in various industrial applications, including medical ones, but their widespread use has prompted environmental concerns. Ahn and co-workers (DOI: 10.1039/C4CS00328D) summarize approaches to the detection of these precious metals, predominantly reactivity-based alkynyl motifs for gold and mixed O/S receptor-based probes for silver.

Conjugated polymers offer a versatile platform for sensing owing to inherent



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interests include molecular recognition, molecular self-assembly and sensor design, with particular interest in the development of modular sensors, where he has pioneered a range of reporting regimes.

properties of super quenching, molecular wire effects, and multivalency. Bunz and colleagues (DOI: 10.1039/C4CS00267A) present the fundamentals and applications of poly(aryleneethynylene)s (PAE) as powerful sensor cores, including for analytes of bio-medical and environmental importance, such as metal cations, anions, explosives, proteins and even whole cells.

Gale and Caltagirone (DOI: 10.1039/C4CS00179F) present a tutorial review on strategies for anion sensing, including mechanisms of recognition by hydrogen bonds and metal ions as well as advanced mechanisms for colorimetric and/or fluorometric readouts such as excimer formation, indicator displacement, or reactivity-based chemodosimeters.

Chang and co-workers (DOI: 10.1039/C4CS00346B) review advances in the fluorescence sensing of copper. Such sensors and probes are vital due to the importance of loosely bound, labile pools of copper that can participate in dynamic signaling pathways.

Daly, Ling and De Silva (DOI: 10.1039/C4CS00334A) highlight recent developments towards photoinduced electron transfer (PET) sensors and switches. PET systems for both single targets and multiple targets are included. The latter lead to more complicated systems such as 'lab-on-a-molecule' and molecular keypad locks.

In their review, Kubota and Hamachi (DOI: 10.1039/C4CS00381K) discuss strategies towards protein recognition and sensing using small synthetic receptors. The review includes examples of protein

recognition and sensing, and covers the biological or diagnostic applications of the receptors.

In a tutorial review, Li, Chen and colleagues (DOI: 10.1039/C4CS00252K) outline the recent developments towards fluorogenic composite materials (FCMs). Systems discussed include organic (graphene and carbon nanotubes) and inorganic (gold nanoparticles) materials in combination with fluorescent dye-labelled species such as sugars, peptides and nucleotides for the fluorescence detection of proteins and enzymes.

Jiang and co-workers (DOI: 10.1039/C4CS00531G) present a tutorial review on recent advances in chirality sensing supramolecular systems. They indicate that the use of such supramolecular sensing systems can be advantageous due to signal amplification caused by multivalent interactions between the sensors and the chiral analytes.

Burrows and co-workers (DOI: 10.1039/C5CS00040H) review state-of-the-art methods in the sensing of gases relevant to automotive emissions using porous materials. In particular, the potential of zeolites and metal-organic frameworks (MOFs) for gas sensing are discussed.

The development of *in vivo* biosensors from carbon nanomaterials is covered in the review by Quin and co-workers (DOI: 10.1039/C4CS00379A). The review discusses recent developments in the use of carbon nanoparticles and nanostructures as sensors and biosensors.

We hope that you enjoy reading these great reviews as much as we did when preparing this themed issue on sensor targets.

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