David G. Churchill, Neurosurg 2017, 2:2
DOI: 10.21767/2471-9633-C1-005

Synthetic steps towards reversible chalcogen-based sensing of essential neurodegenerative disease

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The chemical etiology of neurodegenerative diseases, is multifactorial and relates to proteins, biomolecules, as well as small soluble analytes including metal ions and ROS. The over-abundance of ROS/RNS could be an indication of Alzheimer's and/or Parkinson's disease (PD).1 Recent articles by us and other researchers have begun connecting the dots of this small molecule chemistry. There is an incredible interest in preparing next-generation (e.g. ROS) probes that are reversible, sensitive, and also robust. Hypotheses involve also discrepancies in metal ion concentrations in various regions the brain; some metals are redox active. Concentrations and the innate chemistry of selenium for example may connect to proposed/tentative etiology of dementia. 2 For all of these reasons and more, we feel that the pursuit of studying, e.g., organoselenium chemistry in this context will be fruitful for years to come.3 In this oral presentation and discussion, selenium, a key element in the redox chemistry of life and for its ability to engage in catalysis, is presented and debated in terms of diagnosis (probing), as well as potentially in therapy. To-date, the role of fluorescence and fluorescent molecules in diagnosis, treatment, as well as in biomedical research, has great current medicinal significance; this is the focus of concentrated effort across the scientific research spectrum. In particular, organoselenium and/or organosulfur molecules show great promise in the detection of reactive oxygen/nitrogen species (ROS/RNS) - key factors in ageing/neurodegenerative disease in living systems.4 The boron dipyrromethene (BODIPY) system is a versatile class of fluorescent dye; it is commonly used in labelling, chemosensing, light-harvesting, and solar cell applications due to the many compelling characteristics, including an intense absorption profile, a sharp fluorescence emission spectrum, and high fluorescence quantum yield. As part of our ongoing effort to study chalcogenide systems, dithiomaleimide- and phenylselenide probes (among many others) have been designed, synthesized and characterized. Commonly, fluorescence is quenched by photoinduced electron transfer (PeT) mechanism. These probes show a "turn-on" fluorescence response upon reaction with ONOO- (BDP-NGM) and HOCl (Mes-BOD-SePh) with significant increase in emission intensity with fast response to ROS/RNS. Related studies with superoxide have also been published. Live cell imaging showed that the current probes can be used for the selective detection of ROS and RNS in living systems.5 Time-permitting, we should also like to briefly showcase related fluorescent probes and studies.

Speaker Biography

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