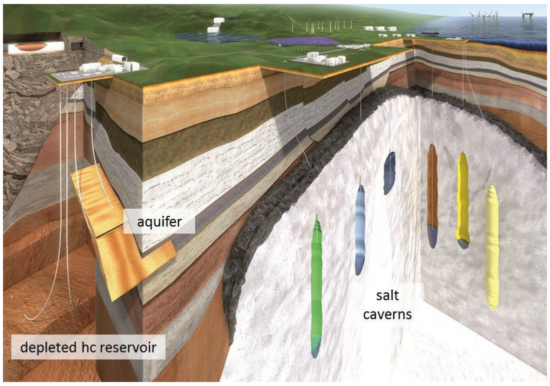
## Storing Energy: with special reference to renewable energy sources

The intermittent nature of many renewable energy sources (such as wind, solar, tides or rainfall) makes it difficult to take full advantage of the potential of these sustainable and renewable forms of energy. The collection of chapters making up this book project shows the many ways and means of solving this problem by storing the energy. Written by international experts, the 26 chapters will present the latest developments in this fast moving field of energy storage. Most of the energy storing processes currently being researched or commercially developed are discussed, giving the reader the opportunity to compare the different processes and to decide which process is best suited for their resources, be it abundant sunshine, wind, tides, rivers, or mountain reservoirs, and whether it is for grid or even off-grid energy storage.

The book will be divided into 5 sections:

1. An Introduction on The Need of Energy Storage
2. Electrical Energy Storage Techniques (including mechanical/thermo-mechanical and gravitational; liquid air; compressed air; pumped hydro with compressed air; and advanced rail energy storage)
    - 2.1. Electrical (including batteries of all kinds; and super-capacitors)
    - 2.2. Thermal (phase changing materials; solar ponds; and sensible thermal energy storage)
    - 2.3. Chemical (hydrogen from water electrolysis; chemical reactions-zeolites/water/inorganic oxides; power to gas; traditional energy storage; large scale hydrogen storage caverns)
3. Emerging Concepts (superconducting magnetic storage)
4. Integration (grid and off-grid energy storage)
5. International Issues (Energy in China and the politics of introducing sustainable energy systems)

*The options for gas (hydrogen or methane or air) storage (by Fritz Crotogino).*



This book project came out of discussions linked to a previous book (www.iupac.org/project/2012-041-1-100) *Future Energy, Second edition: Improved, Sustainable and Clean Options for our Planet*, published in 2014.

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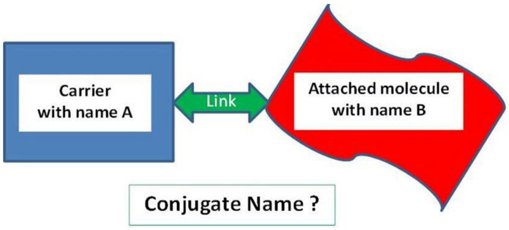
## Nomenclature for polymeric carriers bearing chemical entities with specific activities and names

How to name a complex conjugate and allow easy identifications of the carrier, of the bound specific entity and of the link while respecting the established IUPAC rules as much as possible? This is the problem which this new project intends to solve.

In organic chemistry, the nomenclature allows the unequivocal drawing of the molecule structure. In polymer chemistry, the situation is more complex and one can use either the 'source-based' or the 'structure-based' systems of nomenclature to name a polymer. Source-based nomenclature leads to rather simple names, but it does not reflect the structure of the polymer it names. Information on the polymerization process is necessary to draw it. In contrast, structure-based nomenclature allows the drawing of the polymer structure directly from the name without requiring knowledge of the chemistry involved in the polymer formation. The strict rules of IUPAC organic nomenclature are adapted to the naming of the constitutional units of a polymer.

Recently, the members of the Subcommittee on Polymer Terminology (SPT) prepared a document for the "Nomenclature of Chemically Modified Polymers" (*Pure Appl. Chem.* 87(3), pp. 307-319 (2015)). This document revealed the need for a particular nomenclature system to deal with current, common structures of conjugates which combine macromolecular carriers and chemical entities.

The field of polymeric conjugates is rapidly growing. The development of conjugates depends on the collaboration of people from different disciplines and the name of a conjugate can be different depending on who generated it among the various specialists. The applications of conjugates require the permanent or temporary immobilization of complex chemical species chemically bound to a carrier that can be a macromolecule, a micelle, a microparticle, a nanoparticle, or a large solid support. These complex chemical species



are easily characterized and identified by functional names. In contrast, recognition and identification can be almost impossible if the strict structure-based naming of the conjugate is used, because both the carrier and the complex species are chemically modified. The binding function alters the names of the bound entity as well as that of the polymeric carrier. Sometime this binding function plays an important role, as in the case of specific chemical entities that are to be released by degradation under predefined physical or chemical conditions. In pharmacology, drugs or other bioactive species like peptides, proteins, polysaccharides, or polynucleotides are temporarily attached to polymeric systems for the purpose of being transported up to a targeted site in the human body and released there to exert their therapeutic action. In some applications, conjugates involve molecules with other specific activities, like dyes or radioactive labels, ligands to target receptors present in cell membranes, solubilizing species, stimuli-sensitive entities to make smart systems, or pesticides and insecticides for treatments in agriculture, etc. Some of the carriers of the bound entities can be so complex that they are named using letters like FGFs and VEGF growth factors, albumin and fibrinogen proteins, DNA, siRNA, etc.

IUPAC recommendations for the structure and source-based nomenclatures of polymers have clear limitations when dealing with complex conjugates. This new project aims to create rules that will allow unambiguous and facile naming of such modern complex conjugates together with easy recognition of the moieties introduced to take advantage of their specific activity.

The project is focused on macromolecules (organic or inorganic) suitable for attachment of (or to) complex chemical entities, including small molecules, macromolecules and biopolymers known and named in relation to their utility. However, the recommendations will be applicable to other kinds of carriers (small organic molecule to make prodrugs, inorganic supports, surface and porous systems, etc.) provided they bear identified chemical functions suitable for attachment.

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## Measurement of Photoluminescence Quantum Yields

Quantum yield (QY) is one of the most important quantitative properties of a luminescent sample and robust ways to measure it are essential in the application of luminescence techniques. In this project, the task group will perform an inter-laboratory comparison of the two main methods for QY measurements, the classical relative method based on standards, and the absolute method using integrating spheres which has recently gained popularity.

A previous IUPAC project (www.iupac.org/project/2004-021-1-300; see *Pure Appl. Chem.* 2011, 83, 2213-2228) has clearly shown a shortage of standards for relative QY measurements of solutions. Recently, absolute measurements have become more popular as a result of the wider availability of integrating sphere equipment, but their reliability is still to be established.

Further standards are needed to fully cover the wavelength range of interest, from ~250 to ~1000 nm. Preferred reference compounds have broad and featureless absorption spectra and have proven emission quantum yields independent of the excitation wavelength. The reference values should preferably be those of air-equilibrated samples. The second purpose of the project is to establish the variability of independent QY measurements in different laboratories. Therefore ten laboratories world-wide have been invited to take part in this test. The laboratories are well-equipped and experienced, but are not specialists or method developers in the field. We are interested in find out what is the current practice in a normal good laboratory.

Twenty-two samples have been selected in the first stage of the project. For eight of these samples, the quantum yields are considered very well established. The other samples have been measured against these eight standards, or were measured using integrating spheres. The results of the measurements are currently being collected.

The outcomes of this new project will provide insight into the reproducibility and inter-laboratory variability of QY measurements using the two methods and detail an extended set of standards and protocols for QY measurement.

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