Green Chemistry for Sustainability:

Teaching ionic liquids new tricks & A breath of oxygen for bio-based chemicals.

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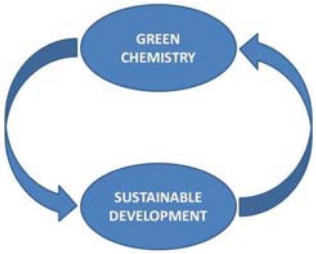
Green chemistry: the design of chemical products and processes to reduce or eliminate the use or generation of hazardous substances.



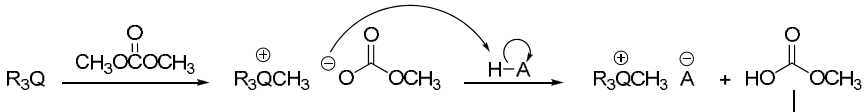
Sustainable development: development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

The figure signifies that many of the tools of green chemistry can contribute to sustainable development, and that sustainable development drives advances in green chemistry.
In our laboratories, we study green chemistry tools at the fundamental and applied level: green solvents, catalysts, green reagents, renewable feedstocks, process intensification, recycle, etc.

In this talk, focus will be placed on two examples.

- **Teaching ionic liquids new tricks.**

A class of halide-free ionic liquids was synthesized, with only CO_2 and methanol as by-products.



R= *n*-buty, *i*-butyl, *n*-hexyl, *n*-octyl;
Q= P, N;
A= Cl, Br, I, CF_3CO_2, NTf_2, NO_3, TosO, L-Phe, CH_3CO_2, $HOCO_2$

Some of these ionic materials show superbasic properties - comparable to phosphazenes and DBU - for a number of C-C bond forming reactions (Micheal, Henry, Baylis-Hillman, etc.). Synergistic nucleophilic-electrophilic interactions are invoked to explain these properties.

- **A breath of oxygen for bio-based chemicals.**

A green reagent such as dimethylcarbonate (DMC) can be used to "oxidatively" upgrade bio-based platform chemicals such as levulinic acid (LA) and γ-valerolactone (GVL). Unlike the more common "reductive" strategies used to transform platform chemicals, here we add rather than remove oxygen, and obtain some unexpected products.