# $CO_2$ Capture by Enzyme-Based Facilitated Transport

**M.C. Trachtenberg, J.-J. Ge, R.M. Cowan, Y.-J. Qin, M.L. McGregor**
The Sapient's Institute / Cook College / Rutgers University
New Brunswick, NJ, USA

We have developed an enzyme catalyzed contained liquid membrane facilitated transport reactor/separator for the selective capture of carbon dioxide ($CO_2$) from mixed gas streams. The liquid membrane is held in place by a hydrophobic microporous polypropylene membrane (Celgard). This continuous process design is ideally suited to $CO_2$ in concentrations ranging from below ambient to greater than that in stack gases. The system is stable and can accept feed or sweep gases independent of relative humidity. It has run for periods as long as 2 weeks without attendance and without failure though we anticipate lifetimes of 3 months to 1 year in the near term.

The design exhibits both high flux and high selectivity. We have demonstrated permeance values in excess of $1.17*10^4$ $cm^3$ $cm^{-2}$ $s^{-1}$ $cmHg^{-1}$ ($3.9*10^{-8}$ moles $m^{-2}$ $s^{-1}$ $kPa^{-1}$). The reactor/separator effectively separates $CO_2$ from nitrogen, oxygen, and/or methane. We have observed selectivities ($\alpha$-values) of 2,500, 1,200 at the feed of 0.1% CO2, and 200:1 at a feed of 2.4% $CO_2$, respectively. Evaporative water loss is replaced from a reservoir. The system design allows autoenrichment by means of vacuum or use of a Bernoulli. This avoids the need for a separate and consumable sweep gas and allows field use based on relative flow rates. Under these conditions the performance declines less than 5% compared with that seen when using an inert sweep gas. This system is readily scaled and can exist in several different geometries including flat sheet and hollow fiber.