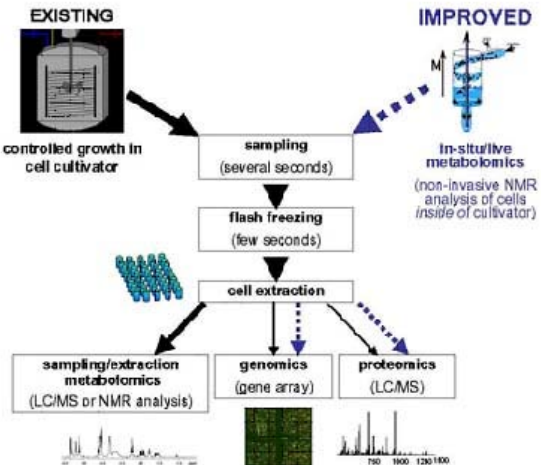
MRI bioreactor aids in understanding the physiology of live cells

Instrument helps scientists to optimize bio-based product processes

Feeding microbes waste and having them convert it into valuable chemicals may sound far fetched, but scientists are closer, thanks to a new technology developed at the Department of Energy's EMSL. A first-of-its-kind MRI bioreactor provides accurate metabolic information for live cells maintained in a controlled growth environment.

Similar to clinical MRI, this *improved* technology uses noninvasive (nuclear) magnetic resonance imaging and spectroscopy (MRI/MRS) methods to monitor microbial metabolite concentrations *in the reactor* without removal or processing. This new technology provides a major advantage because metabolite levels can change significantly due to handling. Further, this technology allows for frequent, repeating measurements without diminishing the sample. Finally, it is compatible with high-throughput genomic and proteomic analyses.



The conventional technology (left) compared to the improved technology (right).

The MRI/MRS bioreactor was used to study metabolites produced by *Eubacterium aggregans*, an anaerobic bacterium of interest for bio-fuel production. The study showed that in addition to known metabolic byproducts -- *E. aggregans* produces significant concentrations of lactate, a metabolite not previously reported. This suggests that the activities of its metabolic networks are different from what were predicted based on older experimental techniques.

Scientific impact: The NMR bioreactor yields accurate metabolite profiles, metabolic pathways, and reaction rates without altering or depleting the sample. This research is one example of EMSL's move from static to dynamic studies in native environments.

Societal impact: Understanding the chemical processes employed by microorganisms under different conditions is an important step in using these microbes to manufacture fuels and other valuable chemicals from waste.

For more information, contact EMSL Communications Manager Mary Ann Showalter (509-371-6017).

Citation: Majors PD, JS McLean, and JC Scholten. 2008. "NMR Bioreactor Development for Live In-Situ Microbial Functional Analysis." *Journal of Magnetic Resonance* 192(1):159-166. Artwork from this article was featured on the cover of the journal.

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