



## Editorial

# Ultrasound—the power of a silent gong

Ultrasound, or sound of frequency  $>20$  kHz, is inaudible to us but many species rely on it for ranging, navigation and communication. Ultrasound has numerous applications in medical imaging, sonochemical processing, nondestructive testing and welding. Biotechnology has yet to benefit from ultrasound.

Ultrasound can destroy microbial and other cells and this well-known effect has perhaps discouraged research on beneficial effects of ultrasound on live biocatalysts and macromolecules. Potentially, finely tuned ultrasound can enhance diffusive transport both within and outside a cell to influence rates of reactions and yields of metabolites. Ultrasound influences enzyme-catalyzed reactions in other ways, including possible effects on formation and dissociation of the enzyme–substrate complex. Substrate- and product inhibition characteristics of an enzyme appear to be influenced by ultrasound. Ultrasound can induce live cells to take-up genetic material from the environment.

Low intensity ultrasound is sufficient for effecting process intensification in biocatalysis. Consequently, ultrasound enhancement of bioprocesses does not cause as much heat generation as occurs in conventional sonochemical processing. Ultrasound enhanced bioreactors, or sonobioreactors, can be an important step forward in modern biochemical engineering. Ultrasound can play a beneficial role in downstream bioseparations by enhancing selectivity and throughput of some membrane-based operations.

Recombinant proteins produced in cells as denatured inclusion bodies require dissolution and refolding to bioactive molecules. We do not yet know if these processes can be assisted by ultrasound, but the potential is certainly there. Effective harnessing of the power of ultrasound will significantly influence the outcomes of many future biotechnology processes.

**Yusuf Chisti**

*Institute of Technology and Engineering,  
Massey University, Private Bag 11 222,  
Palmerston North, New Zealand*

*E-mail address: [Y.Chisti@massey.ac.nz](mailto:Y.Chisti@massey.ac.nz)*

*Tel.: +64-6-350-5934; fax: +64-6-350-5604*