National Institute on Aging

Susceptibility-Matched Multiwell Plates for High-Throughput Screening by Magnetic Resonance Imaging and Spectroscopy

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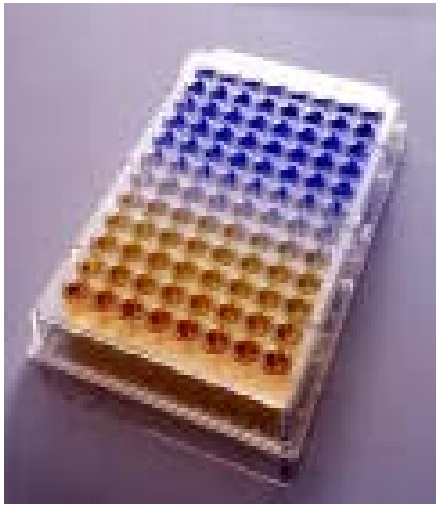

Technology

- **High-throughput screening by NMR spectroscopy offers:**
  - Non-destructive, detailed analysis of chemical composition and structure
  - Samples may be pure chemicals or mixtures
  - Opaque or dirty samples can be analyzed
- **Nuclear magnetic resonance (NMR) spectroscopy** has many applications in clinical chemistry, drug discovery and pharmaceutical quality control *but*:
  - Samples must be transferred to special tubes or flow cells
  - Samples are scanned one at a time

This increases risk of contamination and sample loss and limits potential throughput.

- **NMR-compatible multiwell plates ?**
  - Would eliminate need for sample transfer
  - Could scan 96 wells in parallel
  - Could be handled by standard lab robots for additional assays

Technology

- **Susceptibility-matched multiwell plates permit NMR analysis of samples without transferring them to tubes or flow cells**
  - **Sample throughput is increased**
  - **Sample loss and contamination are avoided**
  - **Sample handling is minimized, enhancing safety**

Standard 96-well polystyrene plate

Solid polyetherimide (ULTEM) plate for aqueous samples

- **Prototype plates built and demonstrated.**
  - **U.S. Patent Application 12/083,501 filed 6/25/2009**

MR Detection of Nanoparticle Probes by Högemann et al.

118 *Bioconjugate Chem.*, Vol. 13, No. 1, 2002 Högemann et al.

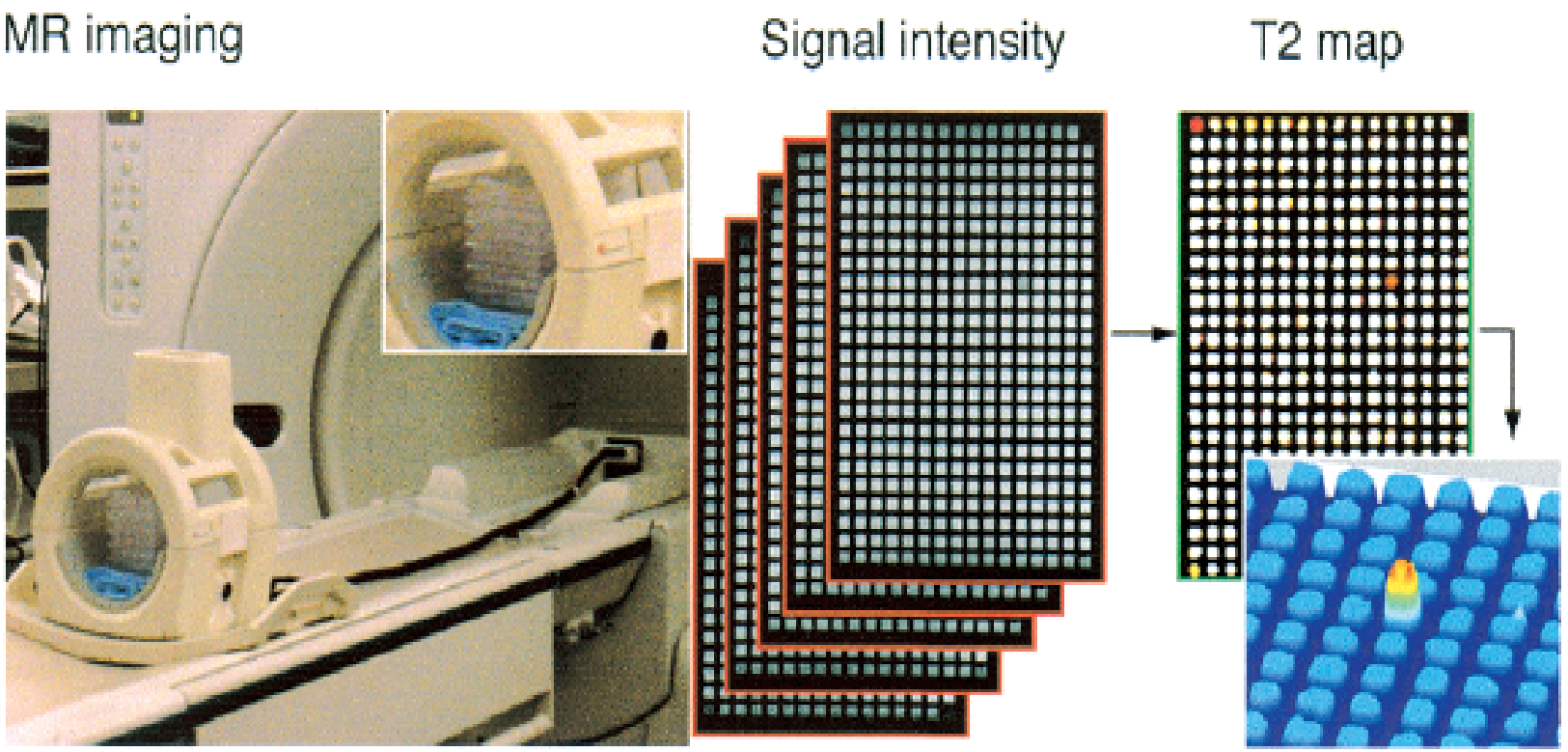

Figure 1. Use of a MR imager for high throughput screening. Microtiter plates were imaged in a quadrature coil with different pulse sequences (variable TE) to yield a series of images for each plate. Signal intensity data were processed to yield a T2 map indicating wells with "hits".

Commercial Applications

- **NMR spectroscopy is already used for:**
  - Detailed analysis of blood lipids (NMR LipoProfile®)
  - Evaluation of drug-target interactions
  - Detection of contaminants in food, industrial chemicals and drugs
- **NMR-compatible multiwell plates would:**
  - Reduce sample handling needed prior to NMR
  - Minimize loss of valuable samples during analysis
  - Minimize contamination of samples or apparatus
  - Increase sample throughput
- **NMR-compatible multiwell plates have potential applications for high-throughput screening of:**
  - Blood serum and other body fluids
  - Potential drugs and drug-target complexes
  - QC for pharmaceutical and chemical products

Collaboration Opportunities

- Collaborators are sought for product development:
  - *Numerical simulation and optimization of plate design*
  - *Realistic test samples to demonstrate practical applications*
  - *Development of dedicated NMR coils for improved sensitivity*
  - *Design of apparatus for true parallel scanning (e.g., multi-channel coils)*
  - *Development of practical manufacturing techniques*
  - *Demonstration of compatibility with existing lab robots*
  - *Side-by-side comparison with NMR sample changers and flow probes*
  - *Extension to magnetic nanoparticle-based immunoassays*

Contact Information

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