

Device and Method for Microscale Chemical Reactions

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SUMMARY

UCLA researchers in the Departments of Bioengineering and Molecular and Medical Pharmacology have developed a passive microfluidic reactor chip with a simplified design that is less costly than existing microfluidic chips.

BACKGROUND

Although positron emission topography (PET) imaging is playing an increasingly important role in the research and clinical management of diseases, access to the radioactive tracers required for such imaging is limited due to the tracers' short half-lives and high cost of production. Digital microfluidic chip technology has been used to miniaturize various assays and synthesis processes and reduce associated costs, including the synthesis of radiopharmaceuticals. For instance, initial research has been conducted on the synthesis of radioactive tracers using a type of digital microfluidic chip known as an electrowetting-on-dielectric (EWOD) chip. Though this platform enabled the demonstration of many important advantages of miniaturized radiosynthesizers, this chip has not yet been widely adopted, in large part due to its complexity and the high cost of prototype chips.

INNOVATION

UCLA researchers in the Departments of Bioengineering and Molecular and Medical Pharmacology have developed a simplified EWOD digital microfluidic reactor chip with passive, rather than electrical, droplet manipulation. This passive manipulation, when combined with a temperature control mechanism, allows for a simplified chip on which it is possible to perform all of the unit operations needed for multistep radiochemical reactions. The simplified chip is also less costly and more reliable than existing microfluidic chips. Applications of the new EWOD chip range from the synthesis of radioactive tracers to the production of radiolabeled therapeutic molecules.

APPLICATIONS

- ▶ Production of radioactive tracers for PET imaging
- ▶ Production of agents for single-photon emission computed tomography (SPECT) imaging
- ▶ Production of radiolabeled peptides and proteins
- ▶ Production of radiolabeled therapeutic molecules
- ▶ Performing reactions at small scale to minimize reagent consumption/cost

ADVANTAGES

- ▶ Reduced cost of reagents
- ▶ Reliable performance
- ▶ Easily operable with a simplified design
- ▶ Chips have a low cost and are disposable

STATE OF DEVELOPMENT

Synthesis of many different radiopharmaceuticals has already been demonstrated.

RELATED MATERIALS

- ▶ Jia Wang, Philip H. Chao, Sebastian Hanet, R. Michael van Dam. Performing multi-step chemical reactions in microliter-sized droplets by leveraging a simple passive transport mechanism. *Lab Chip* 17: 4342 – 4355, 2017.

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INVENTORS

- ▶ van Dam, Michael

OTHER INFORMATION

KEYWORDS

digital microfluidic radio synthesizer;
digital microfluidics; droplet
microfluidics; droplet synthesis;
droplet reaction; radiochemistry;
radiosynthesizer;
radiopharmaceuticals; PET imaging;
radioactive tracers; radiolabeling

CATEGORIZED AS

- ▶ **Imaging**
 - ▶ Medical
- ▶ **Materials & Chemicals**
 - ▶ Other
- ▶ **Medical**
 - ▶ Diagnostics
 - ▶ Imaging
 - ▶ Other
 - ▶ Research Tools
- ▶ **Research Tools**
 - ▶ Other

RELATED CASES

2017-380-0

- ▶ Keng, Pei Yuin, and R. Michael van Dam. "Digital microfluidics: a new paradigm for radiochemistry." *Molecular imaging* 14.12 (2015): 7290-2015.
- ▶ Chen, Supin, et al. "Radiolabeling diverse positron emission tomography (PET) tracers using a single digital microfluidic reactor chip." *Lab on a Chip* 14.5 (2014): 902-910.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,383,235	07/12/2022	2017-380
Germany	Issued Patent	602017035439.2	03/24/2021	2017-380
France	Issued Patent	3523047	03/24/2021	2017-380
United Kingdom	Issued Patent	3523047	03/24/2021	2017-380

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Microscale Device and Method for Purification of Radiopharmaceuticals](#)
- ▶ [Digital Microfluidic Platform for Radiochemistry](#)

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