

Dr. Sarah J. Jenkins

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TO:

Dr. Elena Rostova

Editor-in-Chief, *Nature Biomedical Engineering*
Springer Nature, London
4 Crinan Street, London N1 9XW, UK

Manuscript Title	Deep Learning-Driven Real-time Detection of Microvascular Occlusion in Microfluidic Chips
Article Type	Research Article
Authors	Sarah J. Jenkins (Corresponding), Michael Chen, David A. Harrison
Target Journal	Nature Biomedical Engineering

Dear Dr. Rostova,

I am pleased to submit our original research article titled “Deep Learning-Driven Real-time Detection of Microvascular Occlusion in Microfluidic Chips” for consideration for publication in *Nature Biomedical Engineering* as a Research Article.

In this study, we address a critical bottleneck in organs-on-a-chip and high-throughput microfluidic platforms: the rapid, automated detection of microscopic thrombi and occlusions without flow disruption or manual optical inspection. We present a novel, lightweight convolutional neural network integrated with high-speed micro-particle image velocimetry (μ PIV) that achieves a 99.4% classification accuracy of blockage states in under 12 milliseconds per frame. Our framework was validated on patient-derived whole blood flow models, demonstrating pre-emptive detection of clotting events up to 4 minutes before physical flow cessation occurred.

We believe these findings are highly aligned with the scope of *Nature Biomedical Engineering*, particularly its interest in translating microfluidic and computational engineering technologies to biological and clinical applications. By providing an open-source, hardware-agnostic diagnostic layer, our work offers immediate utility to researchers developing clinical organ-on-a-chip models and automated disease-diagnostic platforms.

This manuscript is original work and has not been published elsewhere, nor is it currently under consideration by any other journal. All authors have reviewed the final version of the manuscript and approved its submission. We have no conflicts of interest to declare.

Thank you very much for your time and consideration of our work. We look forward to the opportunity to share our research with the readers of *Nature Biomedical Engineering*.

Sincerely,

Dr. Sarah J. Jenkins

Associate Professor of Bioengineering
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