



Shriners Hospitals for Children®
Boston, Massachusetts

NEUTROPHIL TRAFFIC IN MICROFLUIDIC MAZES

Neutrophils are the white blood cells protecting us against infections. Current theory is that neutrophils travel from blood to tissues and die in the tissue protecting us from microbes. However, enabled by new technologies for more precise measurements of neutrophil migration, a picture much more complex and nuanced is emerging during various disease processes. Using new microfluidic tools, investigators at Shriners Hospitals for Children — Boston, led by Dr. Daniel Irimia, are learning more about the neutrophil traffic through tissues and how it changes after burn injuries and during wound healing.

In recent work, our team uncovered that close to 100 percent of human neutrophils from healthy individuals, after chemotaxing toward a source of chemoattractant, can reverse direction of migration and move away from the chemoattractant (a process now called retrotax). Boston researchers also discovered that the migration of neutrophils from patients after major burns is severely impaired for weeks after the injury. Moreover, the spontaneous migration of human neutrophils (in the absence of a chemoattractant) can be useful for predicting and monitoring sepsis in patients with burn injuries. To address the logistical challenges in the handling and processing of blood samples for neutrophil measurements, we recently designed devices that can measure neutrophil migration directly from only one droplet of blood.

Recent Publications

1. Hamza B, Irimia D. Whole Blood Human Neutrophil Trafficking in a Microfluidic Model of Infection and Inflammation. *Lab on a Chip*, 2015, 15, 2625-2633. PMC4457540
2. Aranyosi AJ, Wong EA, Irimia D. A Neutrophil Treadmill to Decouple Spatial and Temporal Signals during Chemotaxis. *Lab on a Chip*, 2015, 15, 549-556. PMC4268067.
3. Jones CN, Moore M, Dimisko L, Alexander A, Ibrahim A, Hassell BA, Warren HS, Tompkins RG, Fagan SP, Irimia D. Spontaneous Neutrophil Migration Patterns during Sepsis after Major Burns, *PLOS One*, 2014, 9(12): e114509. doi:10.1371/journal.pone.0114509. PMC4260850.
4. Boneschansker L, Yan J, Wong E, Briscoe DM, Irimia D. Microfluidic platform for the quantitative analysis of leukocyte migration signatures. *Nat Commun.* 2014 Sep 3;5:4787. PubMed PMID: 25183261; PubMed Central PMC4155519
5. Hoang AN, Jones CN, Dimisko L, Hamza B, Martel J, Kojic N, Irimia D. Measuring neutrophil speed and directionality during chemotaxis, directly from a droplet of whole blood. *Technology (Singap World Sci)*. 2013 Oct 2;1(1):49. PubMed PMID: 24809064; PubMed Central PMC4010229

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