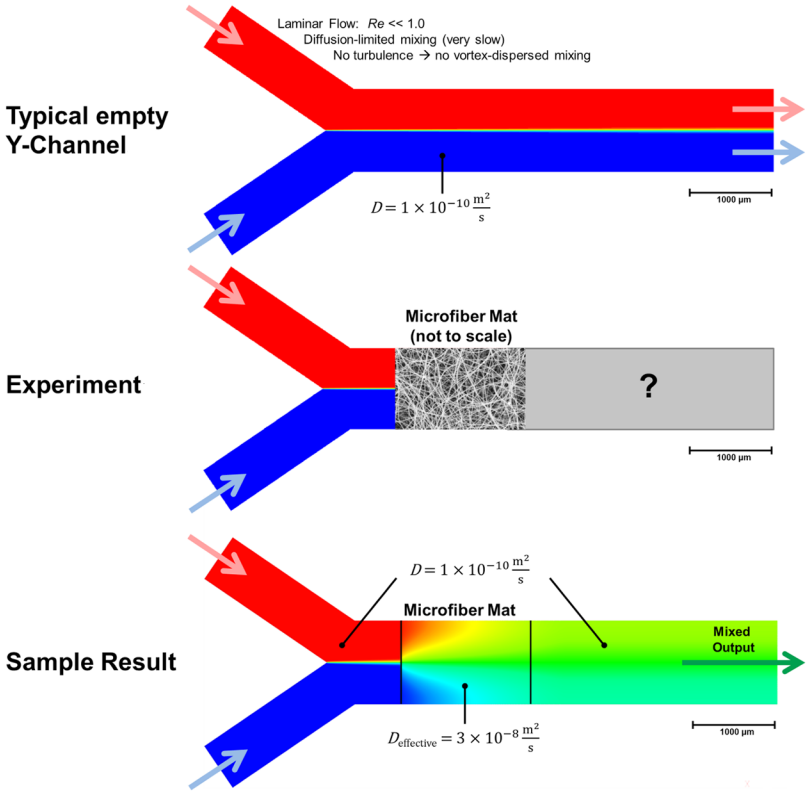
NANOFIBER MATS

By *ANSYS Advantage* Staff

"On the macro scale, turbulence is ubiquitous," says Andrei Georgescu, graduate student at Cornell University's Bioanalytical Microsystems and Biosensors Laboratory. "However, as bioanalytical microsystems and biosensor devices become increasingly miniaturized, the transition from a random, disordered flow regime into an environment with low-Reynolds-number laminar flow is inescapable. So in the absence of turbulence, it becomes much more challenging to efficiently mix adjacent fluid streams." The laboratory is embedding electrospun nanofiber mats into microchannels as a means of dispersing solutes between two initially unmixed solutions. The resulting higher levels of mixing increase reaction rates and make it possible to detect analytes at lower concentration levels.

To understand the relationships between the amount of mixing produced by the fibrous media and the characteristics of the fibers — such as fiber diameter, porosity and embedded mat length — researchers developed a computational soft-body dynamics model to simulate deposition of electrospun fibrous media. They then used the resulting fiber geometries to simulate fluid flow and mixing behavior in the surrounding fluid volume. The team performed meshing in ANSYS ICEM CFD and used ANSYS Fluent for CFD analyses of solution flow and species transport. Modeled results showed, for example, that embedding the microfiber mat in a sample Y-shaped microchannel increased mixing by a factor of 30.



Nanofiber mats improve mixing.

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Learning Experience
ANSYS and Cornell University have developed a unique collaboration that has flourished for well over a decade, helping to extend Cornell's reputation as one of the world's leading research institutions. ANSYS software is used by students and teachers in the classroom as well as project teams and researchers to solve challenging mechanical and fluid-flow problems.