Diffusivity Discussion

*How do you currently measure diffusivity?* Most common methods for measuring diffusivity are 1-D analysis with Franz Cells or equivalent. This method is easy, relatively inexpensive, but takes considerable more time to get results than other approaches. FRAPS is faster and multidimensional, but requires expensive equipment and some level of expertise to perform.

*Consensus of Diffusivity Group 1:* 
Why do we need to measure diffusivity? No one seemed to think it was necessary. Instead, everyone was interested in cellular infiltration. Reaching a particular coefficient of diffusivity does not ensure proper or adequate cell infiltration.

*Group Questions:* 
What parameters need to be stipulated in order to measure diffusivity?  
Can diffusivity predict cell infiltration and subsequent survivability?  
Can porosity measurements outweigh diffusivity measurements? Diffusivity is a material property that can be enhanced/deterred with scaffold architecture?

*Notes:* Most participants were interested in cellular infiltration. A very basic diffusivity measure may not suffice to ensure adequate cell infiltration and survivability but may serve as a threshold, that if not met, will ensure improper infiltration and survivability. In other words, if a minimum diffusivity is not achieved, we can be certain that cell infiltration and survivability will not occur. Nonetheless, such a threshold needs to be particular for the cell type utilized and hence multiple studies with different cell types are required in order to relate diffusivity with proper cell infiltration and survivability as a function of cell type used.

Espin founder made a very good point. He stated, and I quote “my main goal is to sell, none of my clients ask about diffusivity or have specifications of such”.
Diffusivity – Is it a helpful metric for all?

• Not many in the group have experience measuring diffusivity
• Some have experience with hydraulic permeability measurements
• Cannot agree whether or not diffusivity should be applied to industry as a release criteria
  • Potential for limited applicability – maybe it matters for some applications and not for others (cell viability, etc). Differences in scaffold structure (fabrication method, composition, fiber size, porosity, etc) and testing method would preclude direct comparison.
    • Scaffold type, structure, pore organization
    • Wetting properties
• Scaffolds can have similar porosities, but different diffusivities, and possibly neither is sufficient for complete characterization of the scaffold
Diffusivity

- Testing method limitations
  - Sample size requirement
  - Material compatibility requirements
  - Apparatus design – sample mounting (direct manipulation of scaffold), fluid leakage
  - Not in-line; requires completed sample for analysis
  - Costly
  - Time-consuming
  - Need a control and/or reference material/filter, possibly specific to indication or structure (macroporous vs microporous and pores vs. patterned channels)

- Potential quick method (using electrical conductivity method) to determine differences between scaffolds with respect to
  - Batch-to-batch: indicator of variation, not necessarily characterization of specific mechanical property
  - Pre- and post-scaffold treatment/modification/manipulation
  - Pre- and post-sterilization