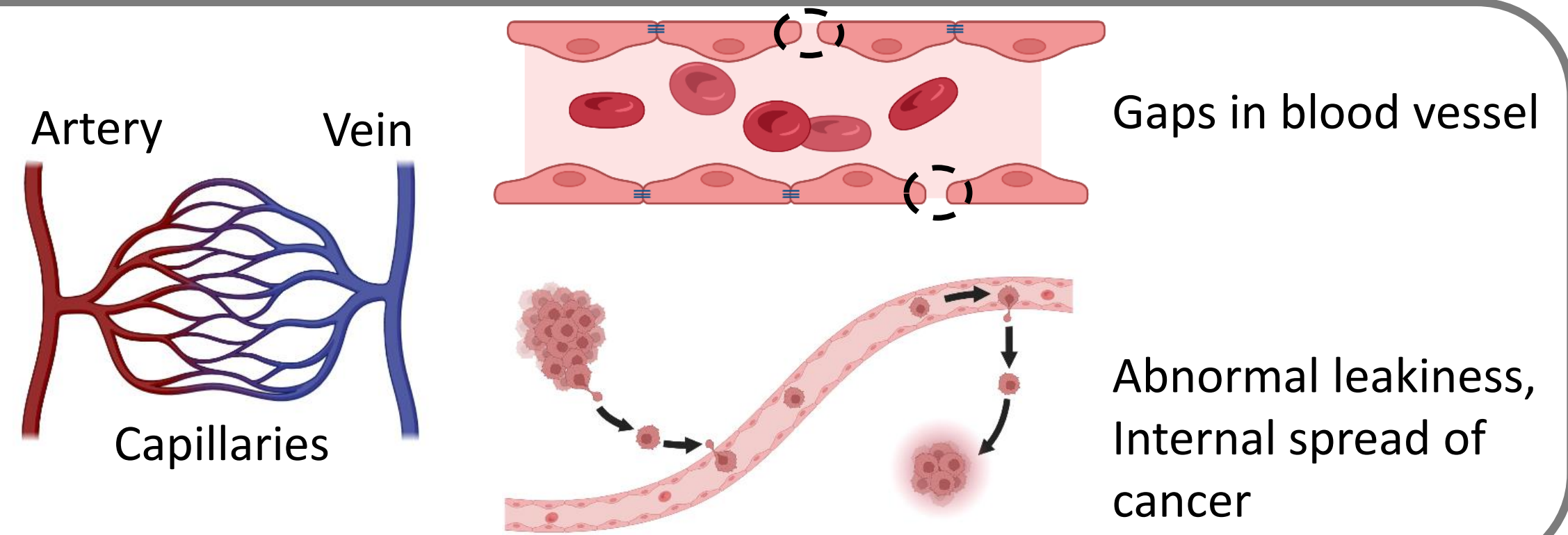


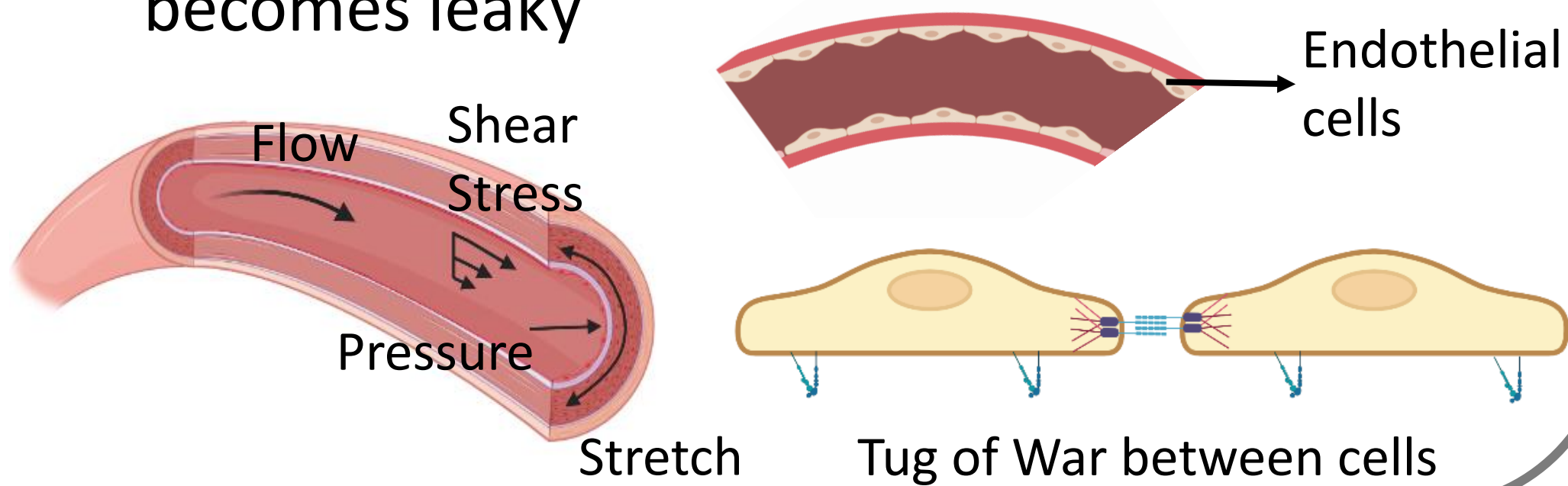
Do you know that abnormal leakiness in blood vessels is found in humans with Cardiovascular diseases, Cancer and also COVID-19?

This *biological behaviour* can be regulated by *mechanical forces*!



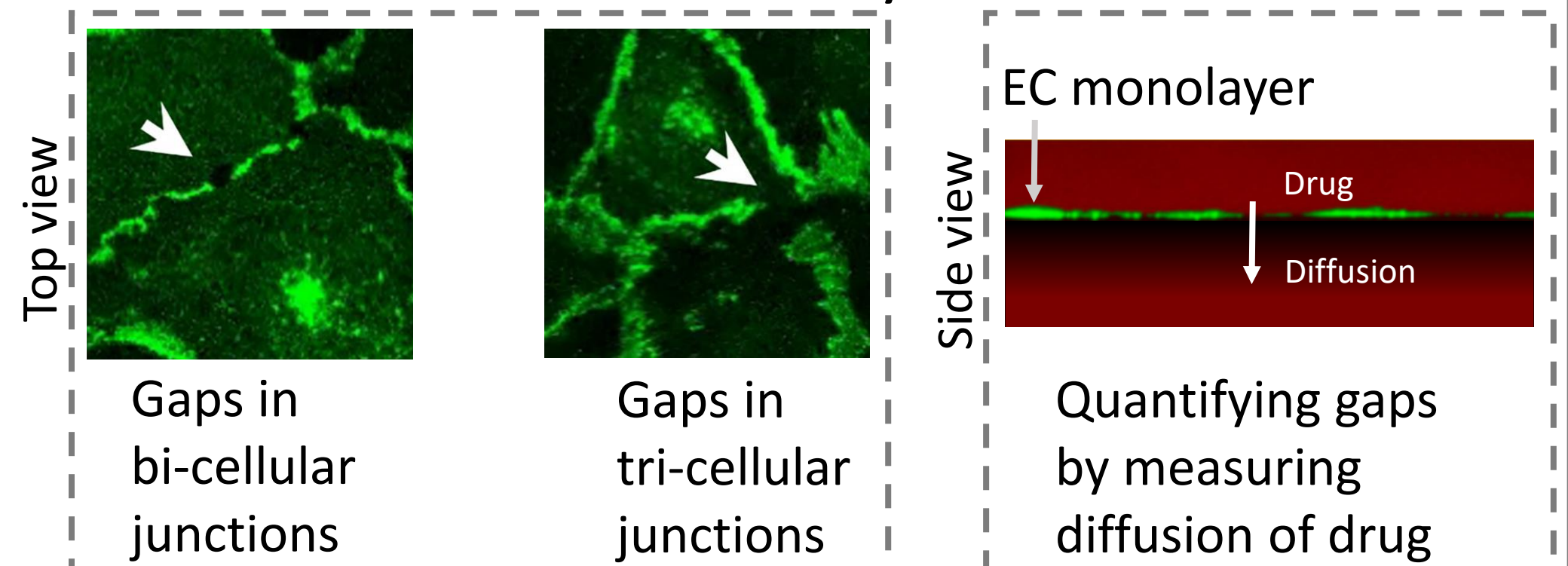
1. The leaky vessel

- The inner lining of blood vessels are made up of a single layer of endothelial cells
- They experience mechanical forces due to flow and cell-cell interactions
- When cell-cell bonds break, vessels becomes leaky



2. Measuring the leakiness

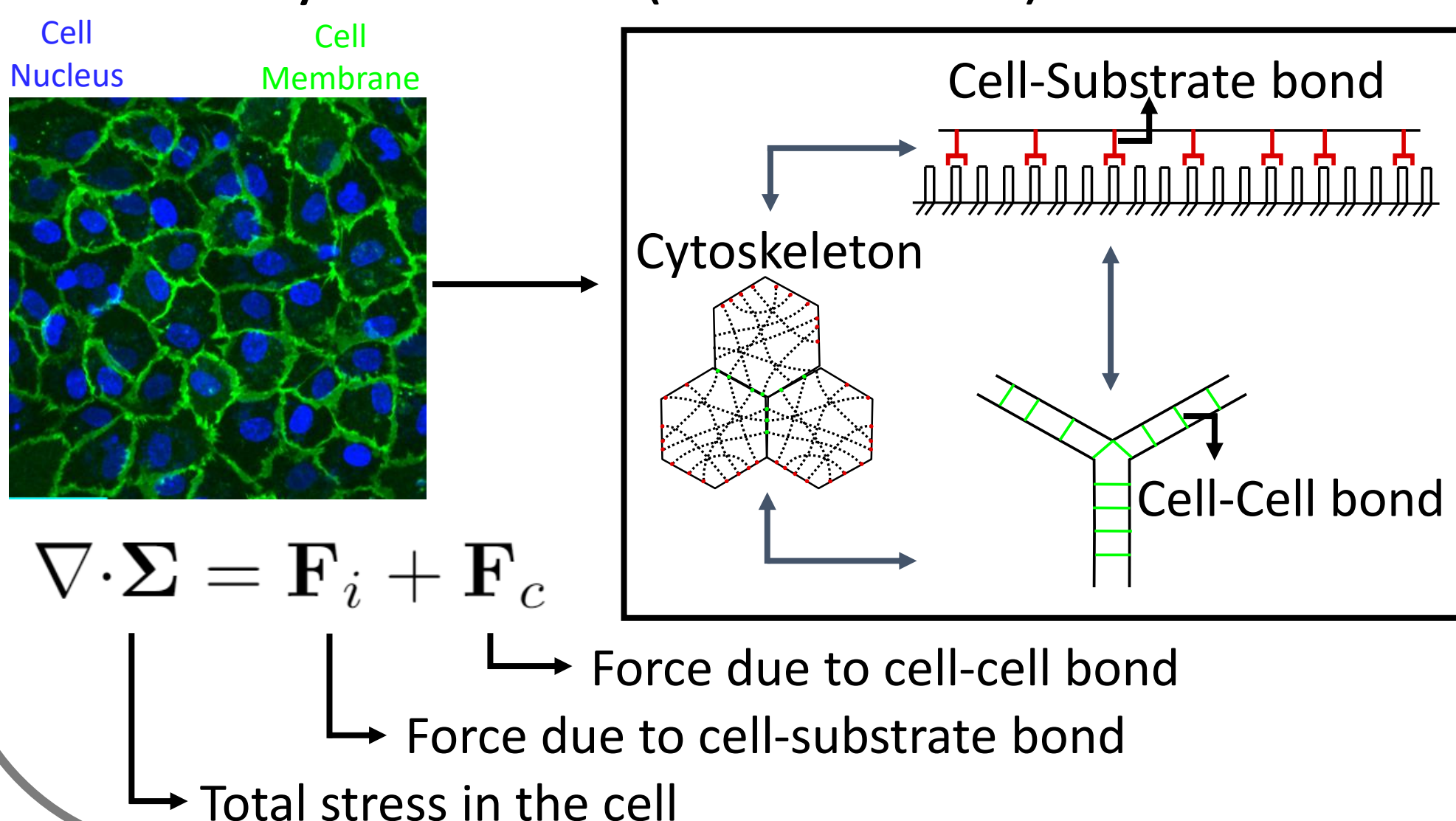
- Diffusion of a known drug across endothelial cell monolayer



Can we apply all the forces in a blood vessel, on cells cultured in lab?

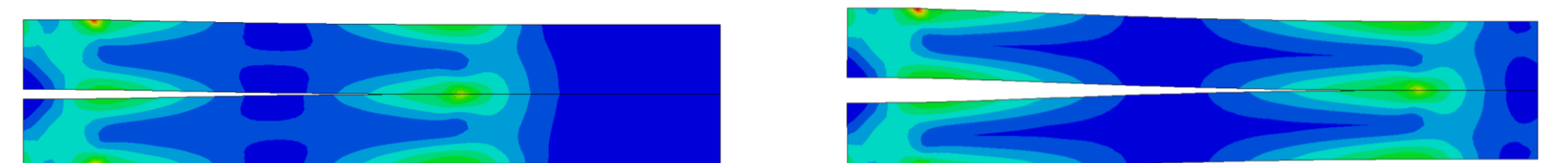
3. Biology to Maths

- Highly dynamic system
- Continuum level, mechano-chemical model
- Modelling three components of the cell:
 - Cell-Cell bonds (VE-Cadherins)
 - Cell-Substrate bonds (Integrins)
 - Cytoskeleton (Stress Fibres)

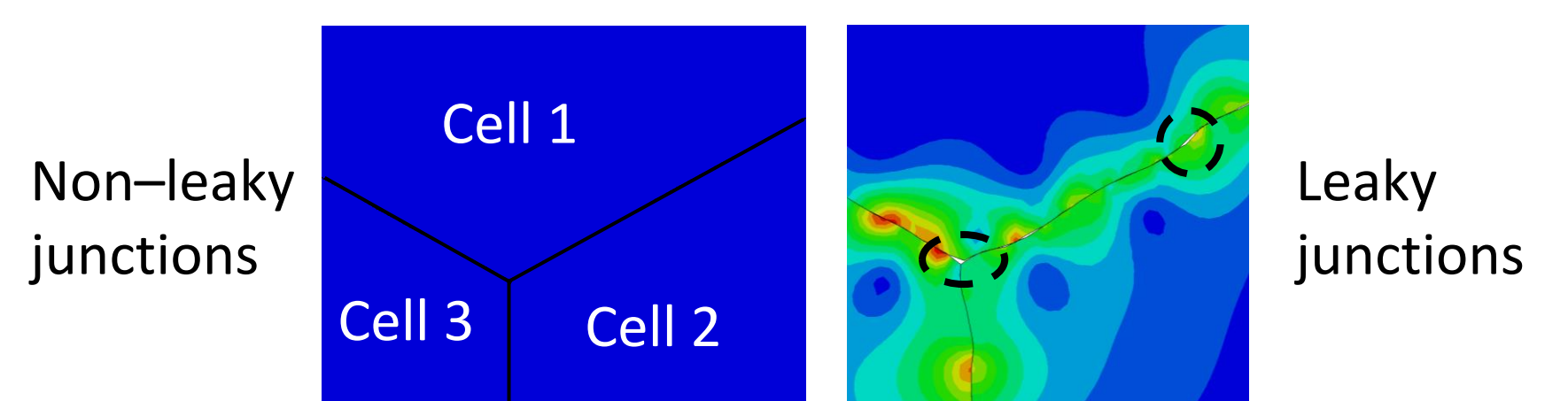


4. Observations from simulations

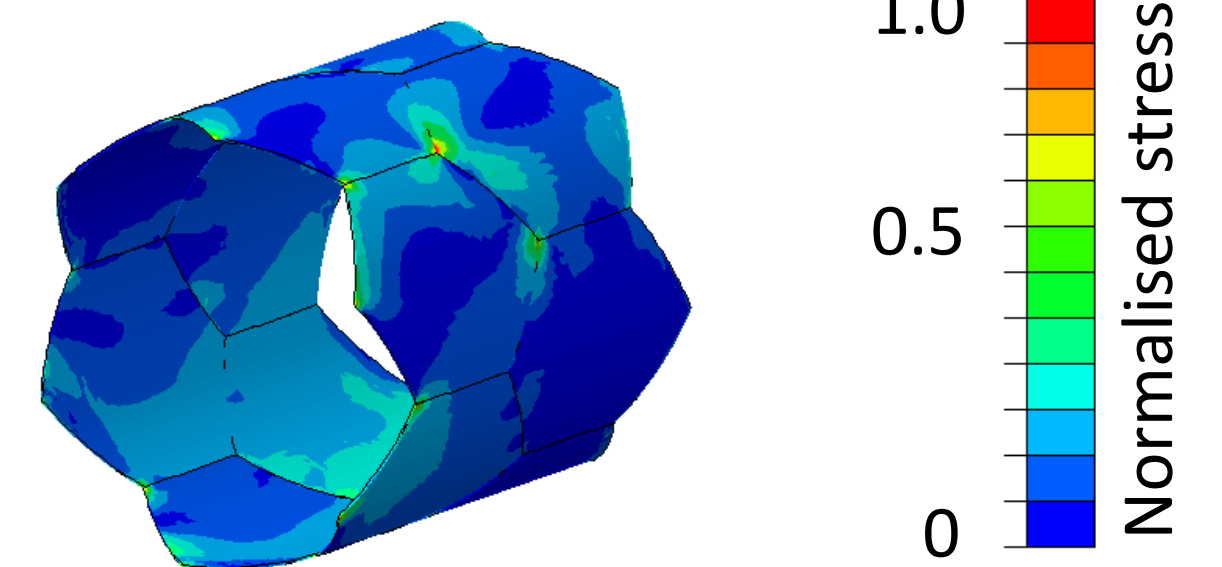
- Zip like behaviour of cell-cell junctions



- Cell junctions in healthy and diseased states

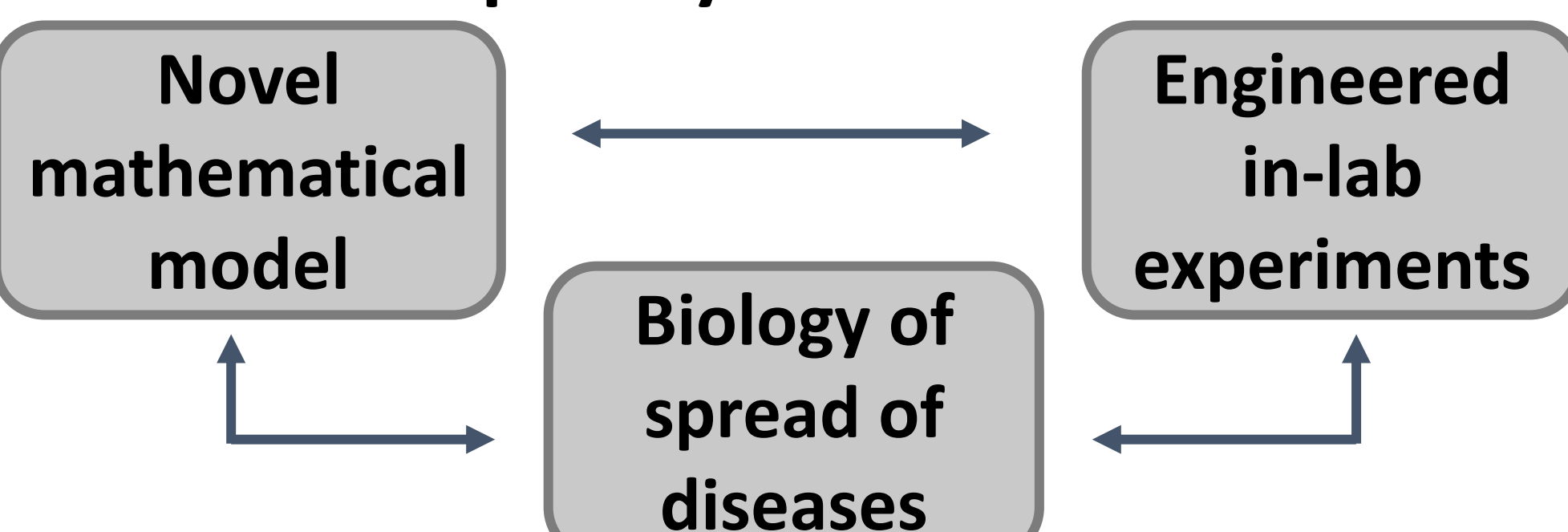


- 3D vasculature



Open Question:
What is the most efficient way to solve a mechano-chemical system of equations?

5. Interdisciplinary Outcomes



6. References

- Escribano et al., PLoS Comput Biol, 2019
- Biorender.com

