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Mathematical modelling of blood-brain barrier failure and edema SARAH WATERS, GEORGINA LANG, DOMINIC VELLA, ALAIN GORIELY, University of Oxford — Injuries such as traumatic brain injury and stroke can result in increased blood-brain barrier permeability. This increase may lead to water accumulation in the brain tissue resulting in vasogenic edema. Although the initial injury may be localised, the resulting edema causes mechanical damage and compression of the vasculature beyond the original injury site. We employ a biphasic mixture model to investigate the consequences of blood-brain barrier permeability changes within a region of brain tissue and the onset of vasogenic edema. We find that such localised changes can indeed result in brain tissue swelling and that the type of damage that results (stress damage or strain damage) depends on the ability of the brain to clear edema fluid.

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