1. Bidomain equation

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1.1. Implementation:

- Implement the bidomain equation as described in the paper of Ethier and Bourgault. The PDE system is described in eq. (1.1)-(1.5), and they assume homogeneous Neumann boundary conditions.

  The discrete problem can be described using specific implementations for `storage`, `reaction` and `flux`, in VoronoiFVM.jl, and from the examples provided in the lectures it is possible to derive the implementation for the backward Euler time stepping scheme[1]

- Perform the 1D test problem described in section 4.1. For fixing the value $u_e(0) = 0$, you can set a Dirichlet boundary condition, or you can implement the penalty method "by hand" in the reaction term (`node.index` gives the node index in the discretization grid).

  For the initial value, solve the stationary problem, and apply the excitation after this.

  You should see a travelling wave moving through the domain with constant speed.

- Run the 1D test problem in on a 2d grid (with a small number of Y coordinates).

1.2. Optionally:

- Run the 2D problem in section 4.2 with the same data as the 1D problem
- Run the same problem with the anisotropic conductivity data from the paper (Come back to me to discuss how to implement this)
- Use alternative timestepping methods from DifferentialEquations.jl (Please come back to me if you want to try this out – in fact the more sophisticated schemes allow for faster solution.)

1.3. Report:

- Introduce the problem and some information on the physical background
- Discuss the finite volume space discretization approach
- Discuss possibilities for the time discretization. Are there any obstacles for implementing the explicit Euler method ?
- Discuss possible solution methods for the discretized problem
- Present simulation results. Suggestion: use 2D space-time plots for the 1D problems.
- Discuss ways to improve performance
- Discuss any of the optional topics

[1] I verified that this works.