Making cell modeling more realistic

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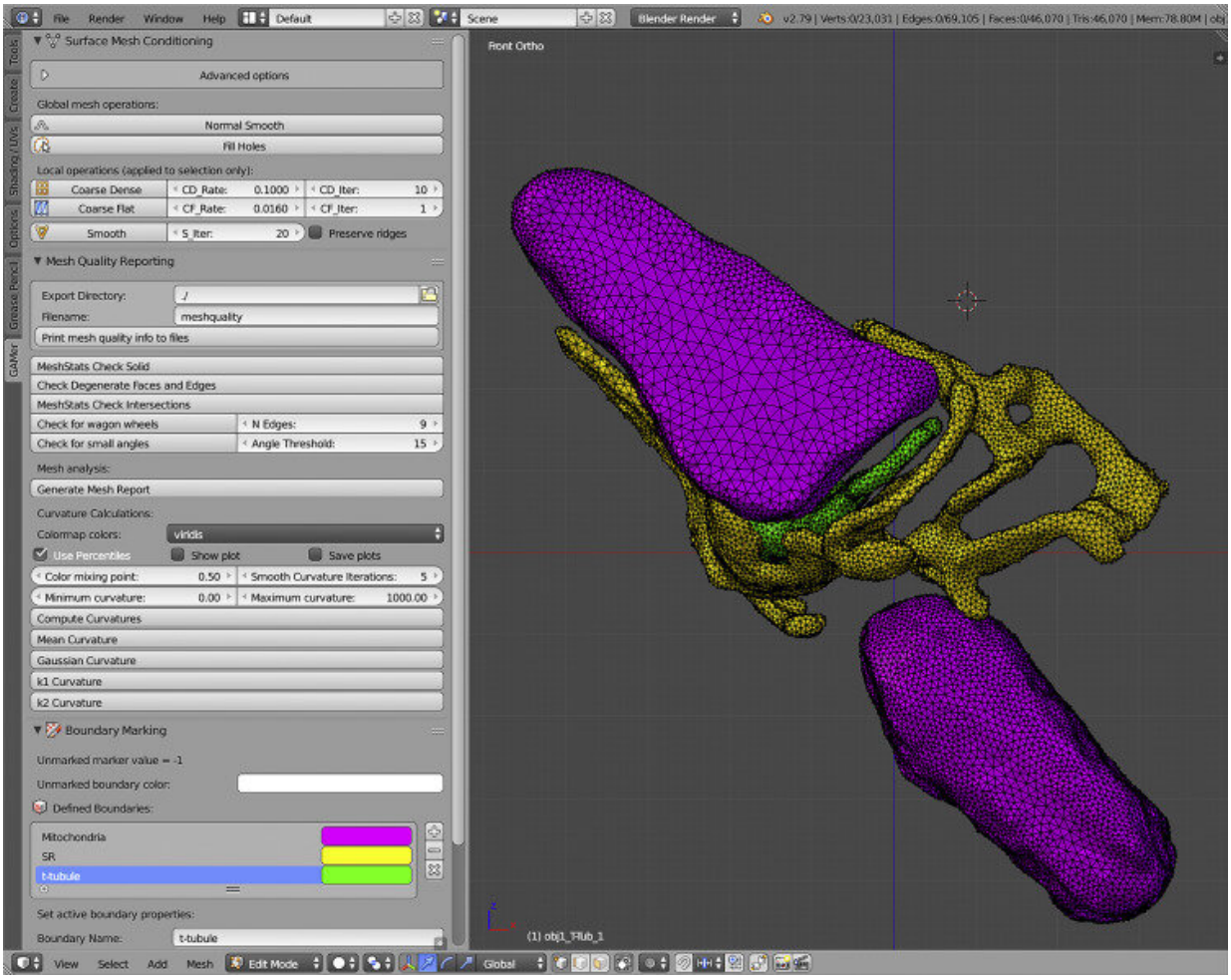

Figure 2Screenshot of the BlendGAMer tool shelf menu in 3D modeling software Blender. The user can call GAMer mesh conditioning, analysis, boundary marking, and tetrahedralization functions by clicking buttons and adjusting settings in the tool shelf. Shown on the right is a conditioned surface mesh of the CRU model. Credit: GAMer 2

Researchers at the University of California San Diego have developed a computational tool that makes modeling and simulation of complex cellular processes more true to life.

The tool, dubbed GAMer 2, simplifies the process of using realistic cell geometries in mathematical models. The UC San Diego team details the work in a paper published in *Biophysical Journal*.

"This work is an important step towards making physical simulations of biological processes in realistic geometries routine. Our hope is that this tool will open a new frontier for biophysical simulations with realism enhanced by geometries derived from experimental images," said first author Christopher T. Lee, a Hartwell Foundation postdoctoral fellow at UC San Diego.

Lee worked on this project co-advised by Padmini Rangamani, a professor of mechanical and aerospace engineering at the UC San Diego Jacobs School of Engineering, and Michael Holst, a professor of mathematics and physics at UC San Diego. This interdisciplinary project also involved UC San Diego chemistry professors Rommie Amaro and J. Andrew McCammon.

Researchers have typically used idealized geometries to develop mathematical models of cell signaling dynamics. That's because they have lacked tools capable of converting structural information from cell imaging datasets to simulation compatible formats.

UC San Diego researchers are bridging this gap with their GAMer 2 tool. It is a mesh generation library that converts structural and biological datasets into geometric meshes, such as those commonly used in graphics and mathematics, Lee explained.

Here is a video of a model of the subcellular structures in a mouse heart

reconstructed using GAMer2. Shown are the mitochondria (magenta), sarcoplasmic reticulum (yellow) and t-tubule (green). The floating glass beads diffusing around the structures represent calcium ions searching for their targets to initiate the contraction for a heartbeat.

This work has uniquely benefitted from the broad expertise and cross-talk between researchers from the Jacobs School of Engineering and Division of Physical Sciences at UC San Diego, the team said.

GAMer 2 is available under an open source license here: github.com/ctlee/gamer .

More information: Christopher T. Lee et al. An Open-Source Mesh Generation Platform for Biophysical Modeling Using Realistic Cellular Geometries, *Biophysical Journal* (2020). DOI: 10.1016/j.bpj.2019.11.3400

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