

Biocellion: A Large Capacity Modeling Platform for Multicellular Biological Systems

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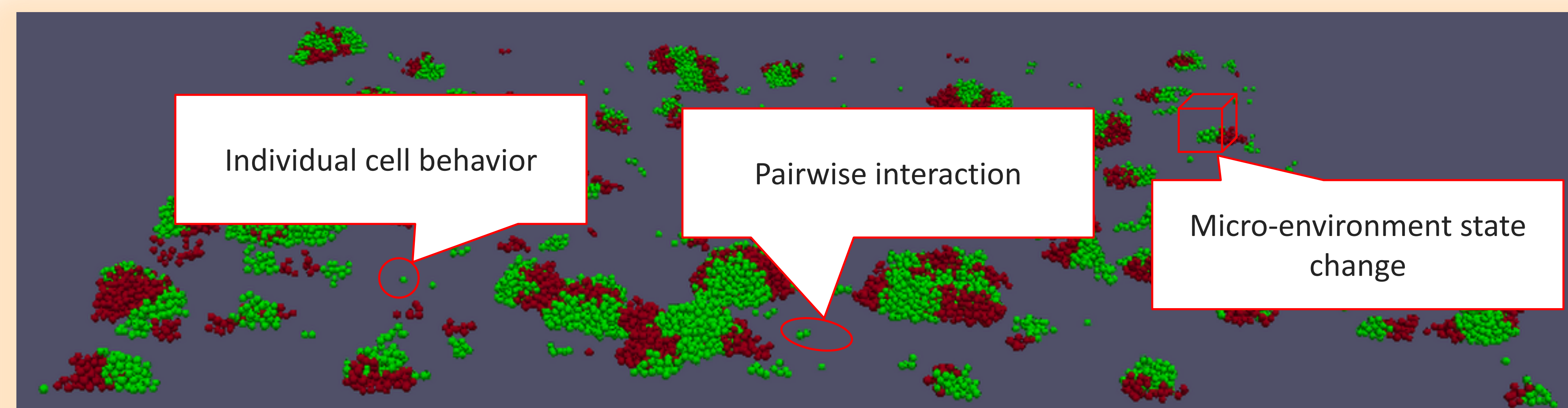
Proudly Operated by **Battelle** Since 1965

Studying emergent many-cell behaviors demands unprecedented capacity: *high-performance* simulation of *flexible* models at enormous scale.

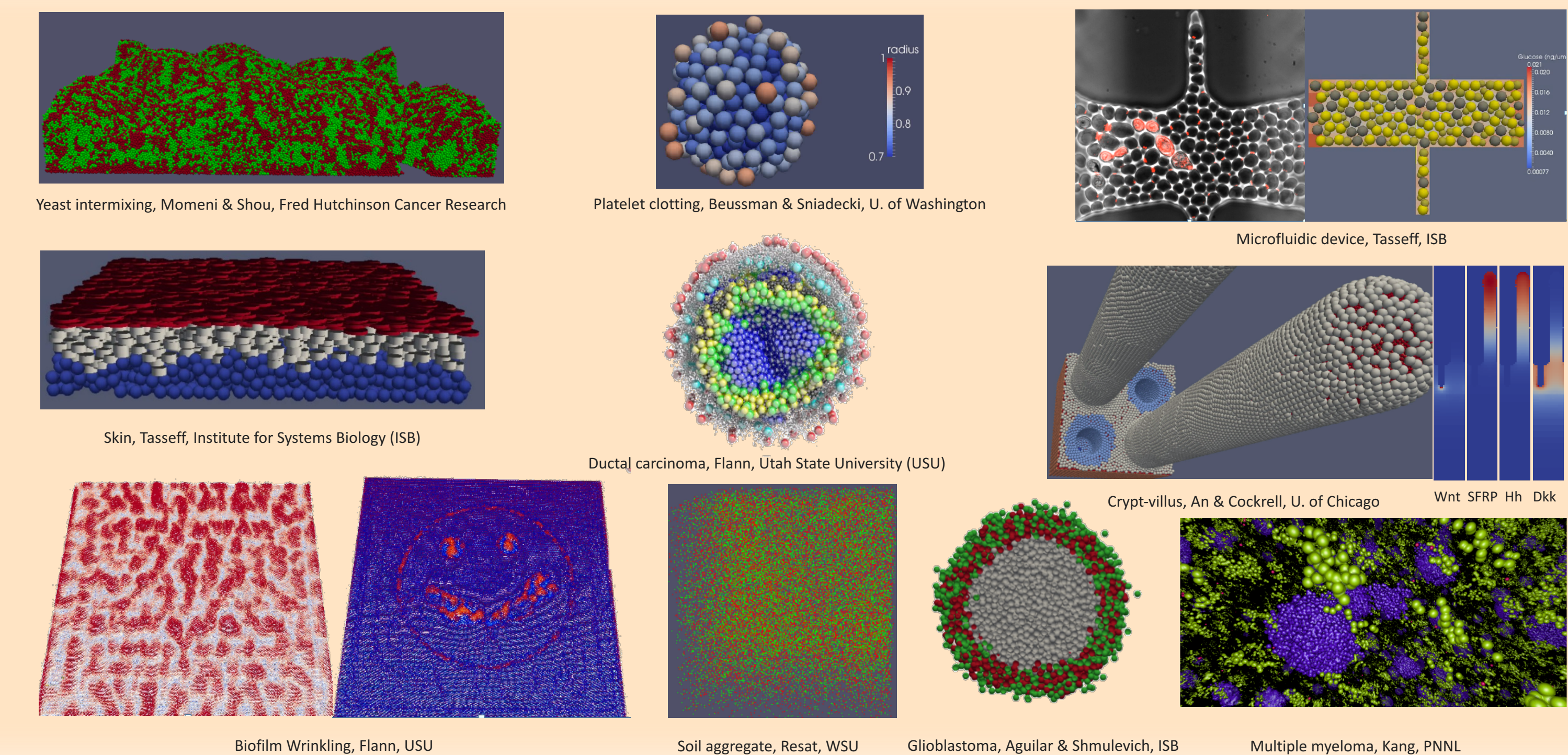
Modeling Capacity = Performance ⊗ Flexibility

Attention to basic building blocks common to modeling all living systems...

...yields the flexibility needed to model in many domains...

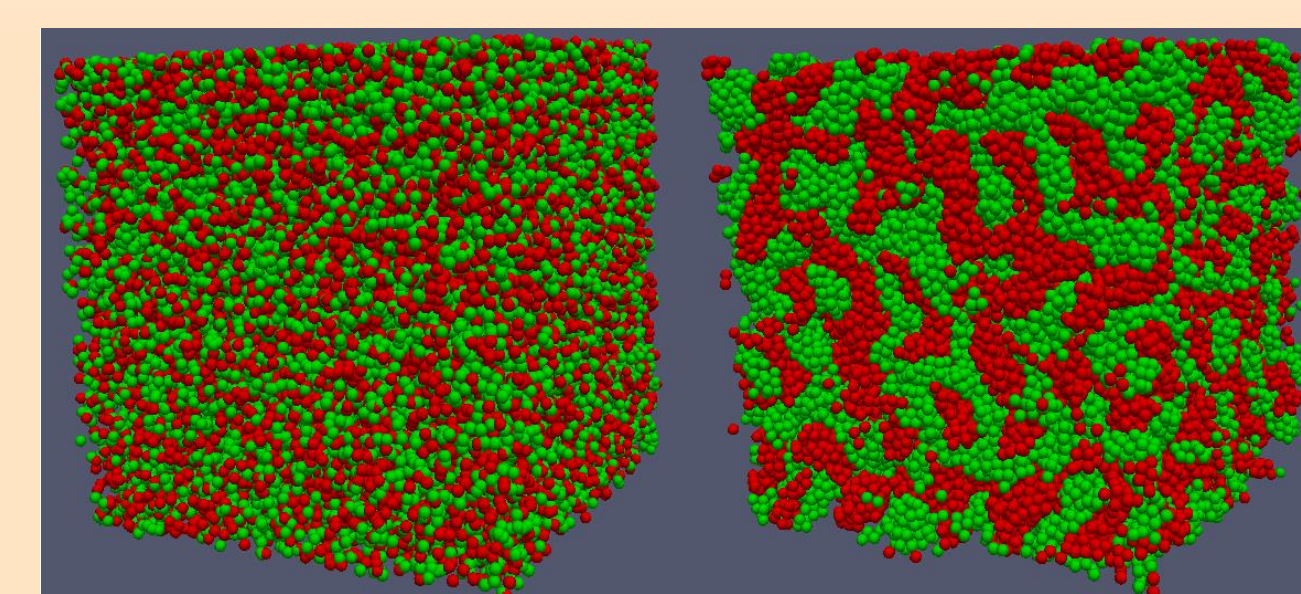


Self: cell cycle, geometry, growth, division, migration, ... ODEs within each cell
Neighbor interactions: shoving, adhesion, phagocytosis, anastomosis, ... short range "N-body" problems
Long-range interactions: secretion, uptake, diffusion, advection, ... PDEs over whole domain

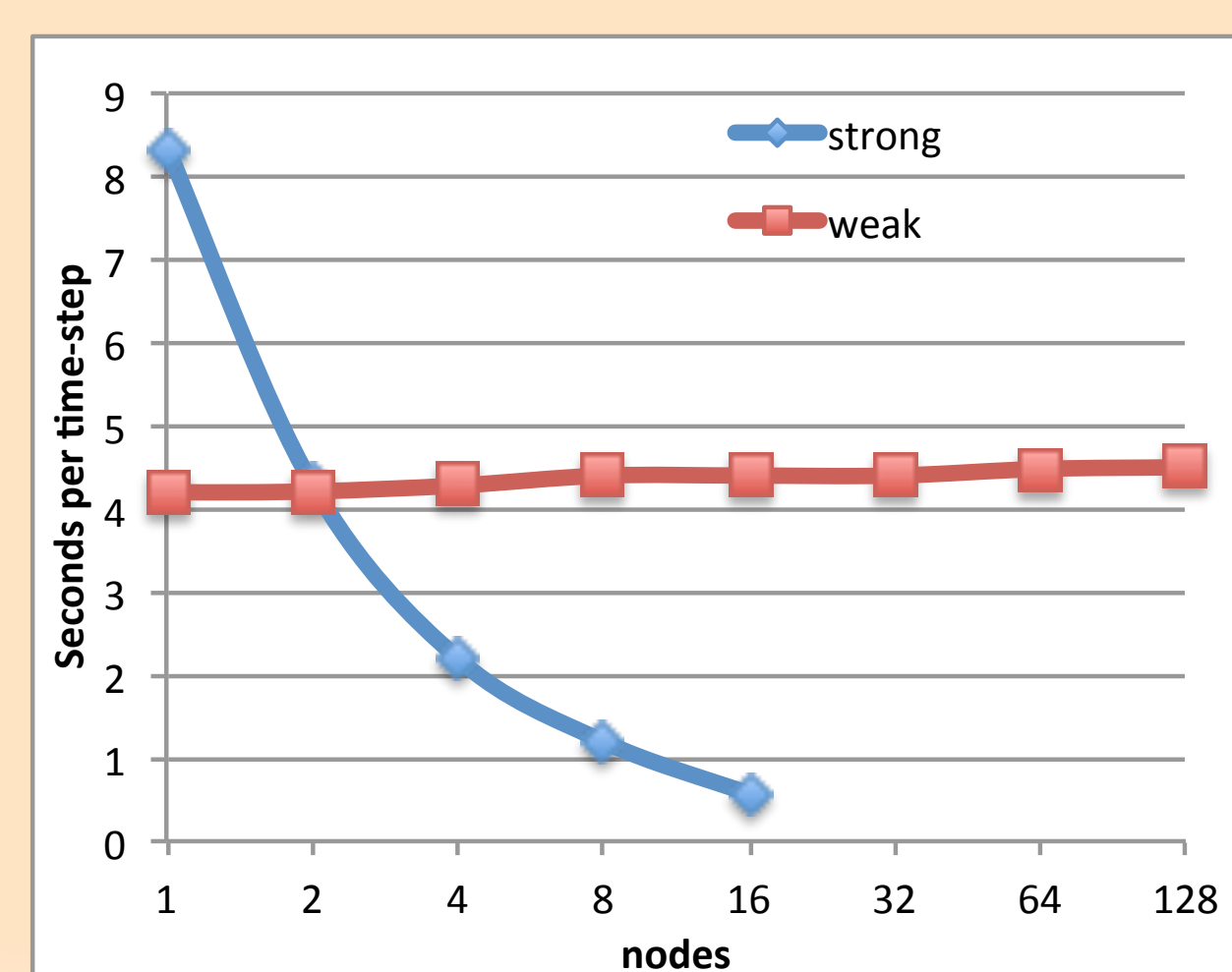


... that leverages our investment in performance-tuning simulation software,

"Cell sorting" occurs when cells adhere preferentially to cells of the same type, forming clumps. Cell sorting serves as a synthetic benchmark for simulation performance. The literature reports no results sorting more than 2M cells. Biocellion sorts >1B cells.



Randomly distributed modeled cells (left) migrate to form the clumped patterns (right).

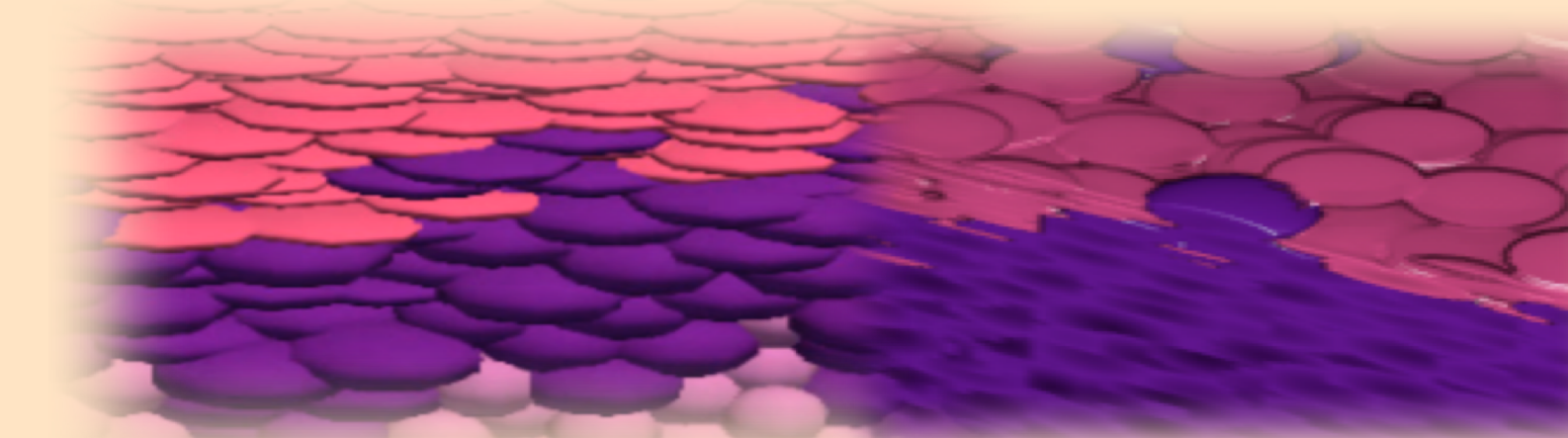


Biocellion sorted 26.8M cells almost 16 times as quickly with 16 computing nodes as with 1 (blue curve): 400x faster than any published result! The number of cells that can be sorted in any fixed amount of time is proportional to the size of computer used (red): on 128 nodes, 128x13.4M = 1.7B cells are sorted almost as fast as 13.4M on 1.

in extensibility,

and in accommodating many-cell models.

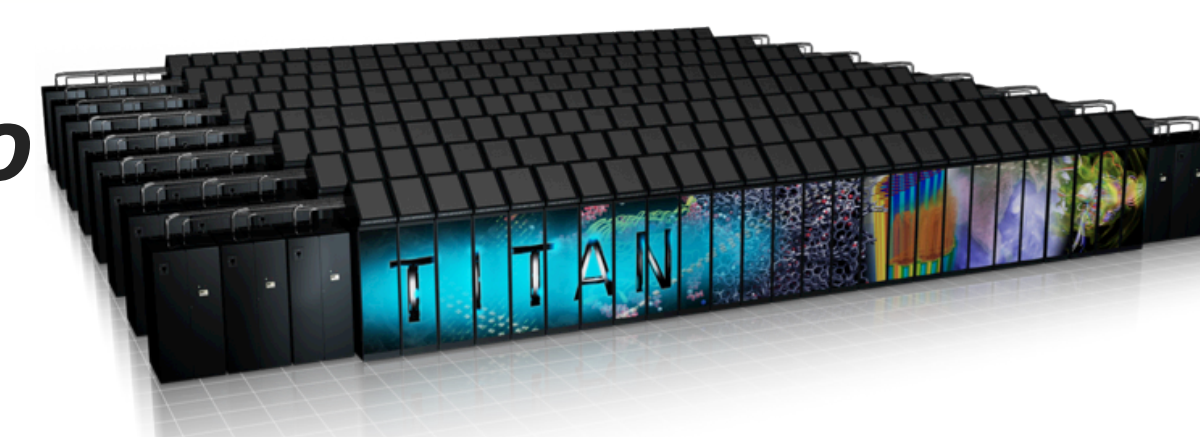
If you cannot incrementally refine your model, you risk wasting your investment. Large modeling capacity allows you to incrementally adopt advances in biological system modeling. For example, a sphere is a good first approximation of most cell geometries. A second approximation better capturing mechanical interactions responsible for tissue morphology is the ellipsoid. Biocellion supports interaction mechanics of arbitrarily oriented ellipsoidal cells:



When initializing cell placement in a virtual experiment, can you extract billions of cell locations from 3D reconstruction of histology slices? Not likely. Biocellion provides built-in support for packing cells along surfaces or between surfaces defined by $f_i(x,y)$ you provide.



So your investment in modeling simulates on laptop to supercomputer with no added work.



See other Biocellion modeling posters here::
 Skin (55), Biofilm Morphology (67), Multiple Myeloma (79)

got model?



All you need to get started...

Prerequisites:

- C & Linux programming skills
- Mathematical modeling skills
- Domain measurements, knowledge and calibration source

Download: biocellion.com/download

Manuals: biocellion.com/documentation

Tutorial: biocellion.com/wiki_root/index.php/Getting_Started

Support: groups.google.com/forum/#!forum/biocellion-support