

Cancersys project Liver Software

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INRIA

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What is Cancersys?

Some key words: EU, Systems Biology, multidisciplinary fundamental genomics and molecular biology approaches, 10 labs in europe.

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Goal of Cancersys:

- establish a multi-scale model for two major pathways involved in the formation of hepatocellular carcinoma. (beta-catenin and ras)
- link from primary hepatocytes to effects at the organ level
- proliferation, micromotility, tissue organization, formation of hepatocellular carcinoma
- design of novel therapeutic strategies to combat this type of cancer

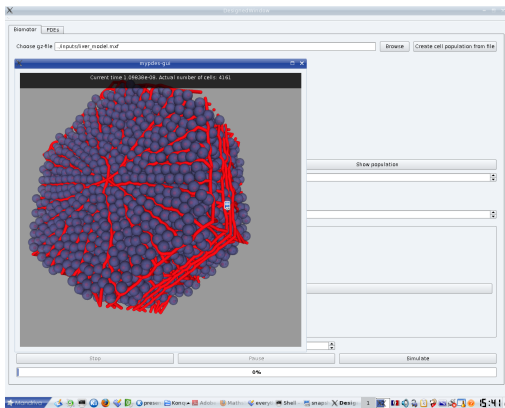


Figure: Screen view of the software through the GUI

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What is missing:

- the image processing part (in progress)
- the dead of the cell part and other options on the cells (waiting for the biological suggestion)
- the complete vasculature functionality (in progress)

What the software already does

What I did since my departure for Leipzig

- 1 The off-lattice agent-based model:
 - moves based on the Langevin Equation
 - division based on the radius
- 2 The graphic user interface (improvement) :
 - Complete interface to control the simulation.
 - Portability of the software (Universal New Library)
- 3 Diffusion of molecules :
 - computed on a regular mesh with the method of the finite differences
 - Decay/Consumption of the molecules diffused.
- 4 The output:
 - OpenGL visualization with snapshots and movies
 - gnuplot outputs
- 5 A documentation and an exchange format

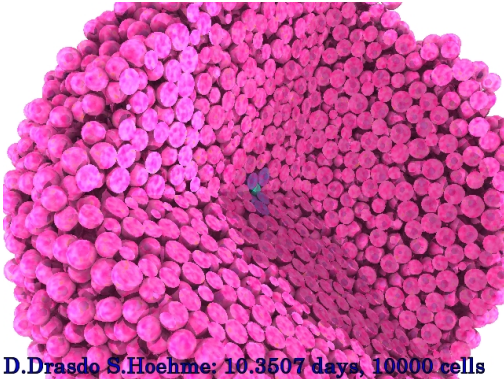


Figure: Division of mutated cells in a 10 000 cells ball

Today, results are trivial in agreement with well-known simple models
(radial symmetry, exponential growth in time, coherent formation of colonies)



Short term future work

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- battery of test to guarantee the validity of the software.
- Comparaison with Stefan Höhme's results.

Possible improvements

- We can discuss the way to upscale to PDE and also how to find parameters and biological datas for those large scales. (Collaboration with Peter Hunter)
- Compute the transport of the oxygen/nutrient from the vessels to the cells
- Simple parallelization of the different loops in the code
- an integrated battery of test to guarantee the validity of the test case