Summer 2011 research summary

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Platelet adhesion modeling and programming is the project I have been doing during the summer. The study is important because that the binding of GPIb $\alpha$ (platelet glycoprotein (GP) –Ib $\alpha$ )

And vWF (von Willebrand factor) is the initial step for forming thrombi, and this model might become a foundation of some of our subsequent study of blood clot project.

The modeling is mainly about four parts:
- Fluid – Lattice Bolzmann model
- Platelet–membrane surface model
- Fluid-platelet coupling– Lattice Bolzmann-Fictitious Domain Method
- Adhesion– Monte Carlo simulation of binding of vWF(von Willebrand Factor) and GPIb $\alpha$

In the adhesion model, vWF and GPIb $\alpha$ are distributed to platelet surface and substrate mesh. In addition, we adopt Bell model to simulate the forward( bond forming probability) and reverse rate( bond detaching probability). Right now, we are able to simulate the platelet binding and detaching as well as the flipping of platelet inside the fluid domain, but the parameters may need to be modified to so the simulation results could match the experimental data.

Surface reaction will also be considered in the model in the near future, and GPU as well as MPI version will be developed to increase the computation efficiency.