

Career development plan.

Name of fellow: ASTANIN Sergey

Location: Dipartimento di Matematica, Politecnico di Torino, Italy

Name of supervisor: PREZIOSI Luigi

Date: 1 September 2005

Brief overview of research project and major accomplishments expected.

The final goal of the research project is to contribute to the global effort of simulating the cancerous tumour growth, and thus improve our understanding of the phenomenon and discover better opportunities of cancer treatment. In this project the focus is at tumour level phenomenological modelling and cell-tissue interscale links. In particular, the primary tasks are:

1. Extension and generalization of existing mathematical models of tumour cords for the case of asymmetric configurations of various dimensionality. Development of appropriate numerical method and computer simulations. We expect to reproduce asymmetric properties of the growth, that are observed in experiments.
2. Development of mathematical framework for more realistic models of the growth in the tissue. In these models we shall characterize tissues as heterogeneous media and shall take into account multiphase interactions of the constituent parts of the growing tumour and effects of tumour plasticity. We expect that this approach will open opportunity to adapt modelling to tissue-specific cases. Preliminary numerical simulations are expected by the end of the first year of research.
3. Implementation of new tumour growth visualization techniques to benefit from the state of the art computer graphics technologies for further improvement of multiscale tumour models.

Long term career objectives (over 5 years).

Goals:

- Academic/research position in the area of applied mathematics.
- Development of international collaborations with an aim to continue working at European level on the modelling of complex biological systems in medicine and biology.

What further research activity or other training is needed to attain these goals?

- Post doctorate position.

Short term career objectives (1-2 years).

1. Research results.
 - Anticipated publications.
 - Preziosi L., Astanin S. (2005). Modelling the formation of capillaries. In A. Quarteroni (ed.), *Complex systems in biomedicine*. Springer.
 - Anticipated conference, workshop attendance, and/or seminar reports:
 - 1st Summer School and Scientific Workshop “Dynamics of Tumour Growth, Signalling and Chemotaxis”, Puerto de la Cruz, Tenerife, Spain, September 2005.
 - 2nd Summer School and Scientific Workshop, Crete, Greece, September 2006.

- Workshop “Modelling Cellular Systems with Applications to Tumour Growth”, Bedlewo, Poland, September 2006.
 - Network meeting in Paris, 2006–2007.
2. Research skills and techniques.
 - Advanced comprehension and scientific attainments in the following areas:
 - Porous media mechanics.
 - Continuum mechanics.
 - Biomechanics.
 - Transport phenomena in biological tissues.
 - Computational methods for PDE, in particular for reaction-diffusion-convection systems.
 - Experience in portable and scalable numerical programming.
 - Mastering visualization techniques.
 3. Research management.
 - Ability to allocate sufficient time and effort to the problem, and effectively share it between theoretical investigations, model analysis, and numerical experiments.
 - Regular reports at internal seminars and workshops to represent the current state of the research.
 - Self-controlled management of the development of corresponding numerical software.
 4. Communication skills.
 - Multiple presentations of the scientific results and conferences and workshops.
 - Discussions of the scientific topics with the network collaborators, as well as interactions with researchers from related research domains.
 - Improvement of spoken and written English, writing paper and reports for international journals.
 - Intensive studies of Italian language.
 5. Anticipated networking opportunities.
 - Close collaboration with network partners from Spain (Miguel Herrero) and U.K. (Helen Byrne, Mark Chaplain).
 6. Other activities with professional relevance.
 - Maintaining and updating MCRTN web site.
 - Collaboration with Roeland Merks (Belgium).
 - Ph. D. Thesis defence in Moscow Institute of Physics and Technology, 2006, Russia.

Date and signature of the fellow

Date and signature of the supervisor

1 September 2005.