Mathematical Modeling of Biological Systems and of Linguistics

Since its beginning, the IM - AGIMB institute has been contributing in an invaluable way to a much-needed interdisciplinary effort by supporting biomathematics workshops, lectures, and courses. This comes in the direction of mitigating the lack we have in Brazil of scientists with a solid common background in the mathematical sciences and in the biophysical sciences. The full impact of such contribution will be consolidated only in the next few years, when young researchers and students that participated in the different events start to develop research in those areas. It should also be pointed out that the research activities of the IM-AGIMB influenced directly the development of several fields. To cite a few, we point out: Advances in mathematical techniques for respiratory function monitoring, by W. Zin and collaborators. Modeling of the circulatory system, by R.Feijóo and collaborators. Fractals in biology, by L. Bevilacqua. Scaling limit techniques of kinetic models (Boltzmann equation), which started to be used in a very effective way in the joint work developed by F. Chalub, P. Markowich, and B. Perthame to tackle chemotaxis problems. Effective algorithms based on tridimensional tomographic methods to tackle transmission microscopy problems in the macro-molecule imaging, which was developed by J. P. Zubelli jointly with the group of G. T. Herman (CUNY). New techniques of epidemiology and virus dynamics, especially those using quasi-species equations and evolutionary biology (Hofbauer, May, Nowak, Sigmund). The study of flagellated micro-organism mobility by means of geometrical mechanics techniques, in the work developed by J. Koiller jointly with K. Ehlers, G. Huber, e G. A. Araujo. The study of symmetry in the genetic code and finite groups and preservation of symmetries in the evolution of the genetic code.

IM-AGIMB has been also instrumental in the development of research in stochastic modeling in linguistics and the nurturing of human resources. The main three topics of research were: 1) probabilistic methodology developed in order to study linguistic chains, with several relevant contributions by A. Galves, Fernandez, Gabrielli, Guiol, Collet, Duarte, Garcia, Cuesta-Alberto, Fraiman, Svarc; 2) linguistic-probabilistic modeling with important contributions by C.Galves, A.Galves, Duarte, Peixoto, Mandel, Sândalo, Abaurre, Abadi, Garcia; 3) modeling the interface syntax/phonology using optimality theory, with relevant contributions by Abaurre, C. Galves, A. Galves, Mandel, Sândalo.