

**Research Plan**  
**for the research stay of Gheorghe Păun**  
**at MTA SZTAKI, Budapest**  
**in the frame of the Centre of Excellence project**  
**(June 24 – August 05, 2004)**

The main topic of research planned for this visit is membrane computing in relation with the theory of grammar systems.

Both these areas are well established branches of theoretical computer science. Grammar systems (with the main classes: CD grammar systems, PC grammar systems, colonies, eco-grammar systems) is an area in formal language theory modelling multi-agent systems via sets of grammars which cooperate according to specified protocols in generating a unique language, and membrane computing is a field of bio-computing with the aim of abstracting computing models (called P systems) from the structure and the functioning of living cells.

Although the two areas deal with related topics (distributed and parallel computing), up to now no attempt was done to bridge them, to borrow ideas from one domain to another one. The investigations planned for the stay of Gh. Păun in Budapest have as a central goal such a bridge.

More technically, topics of the following types will be addressed:

- Using cooperation protocols from CD grammar systems in P systems. For example, a promising idea is to use the so-called *t*-mode of cooperation as a basis for moving string-objects through the compartments of a P systems, since a string generated by the *t*-mode of derivation can be considered as a so-called “adult” string, which does not change anymore.
- Considering in P systems the possibility of communicating strings across membranes *by request*, as specific in PC grammar systems.
- Conversely, it seems to be attractive to consider PC grammar systems working with multisets of strings, like in P systems.
- A colony is a grammar system with components as simple as possible. This general idea will be explored also for membrane computing, considering P systems with as simple as possible elementary membranes, placed in a common environment.
- The idea of a common environment for several computing agents, with rules also for environment evolution, is central in eco-grammar systems, and it might be of interest to be considered also in P systems area.

Of course, during the investigations it is possible that some of these issues will prove to be richer in possibilities than others, and it is also possible that further topics will be considered. However, the research plan is rather realistic and it is highly probable that it will be covered by interesting contributions to both grammar systems theory and membrane computing.