CONCLUSIONS

In this text we have attempted to set the extension of an intuitive idea, of content seemingly pervasive to some scientific disciplines, as a formal methodology to tackle one of the least understood topics of interest to current research: the science of elaborating coarser representations from a finer framework. An already existent formalism that arose from the question of 'how do genetic algorithms work' has shown that it has something to offer in this task.

It is interesting that techniques inspired in natural selection, –a biological phenomenon-, could be applied to give further insight on physical processes that involve a large number of degrees of freedom and consequently observe evolution in a similar sense. Such 'close' examples might be exponent on the key issues behind the appearance of strategies and the adaptive aspects of evolution in complex systems. Central to this idea is the consideration of an informational substrate for the study of their dynamics, that could be handled in principle by techniques such as genetic algorithms.

A common language of what we have presented here engages the existence of a fitness landscape which pinpoints for preferred locations in the somewhat blind evolution of a system. Such approach makes advantage of situations where there is present a natural bias for these outcomes in a process that has a large number of possible results; however this is only a heuristic to identify potential endings. The origin of a fitness landscape should be expected ultimately in the somewhat fundamental theory concerning the system.

Stellar nucleosynthesis, an interesting example that complies with the former ideas, has been examined; it exhibits features such as competition for resources that may turn its further study compatible with approaches of genetic algorithms; a relationship between reaction rates and fitness landscapes could give interesting insights into the common grounds of chemical and biological evolution.

Study has been concerned in the development of tools that tackle the open question of how to describe a macroscopic system from its microscopic substrate; the renormalization group has been one important tool in achieving answers in some cases, and techniques that have been developed from it are likely to have an important role in future research on these questions.

It was found in the study of the Ising model that the renormalization group 'erases' the modularity posed by one inhomogeneity in the interactions between spins for the one-dimensional case; this was identified with the transformation to representations associated with higher temperatures, and work on more inhomogeneities and correlation lengths should follow.

Another main result is that a system which exhibits modularity should bear a representation in which it can be decomposed, and formally show a hierarchy in the solution of the evolution equations of its building blocks; a representation of this feature could be given by a transition triangular matrix governing its dynamics in the appropriate basis.

Overall we have given some general guidelines attempting to promote the use of some tools that have found a number of applications in problems of engineering and the sciences of the artificial. To explore what these can offer to explain biological questions from a physicist's perspective will certainly help narrow the gap between current knowledge about the emergence of the adaptive component of many of the complex systems.