BIOLOGICAL COMPLEXITY

A SYMPOSIUM

Editors: Eduardo Mizraji
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CONTENTS

Prologue

BIOLOGICAL COMPLEXITY

The development of instruments for the analysis of complex systems is an enterprise that concerns researchers coming from a large variety of scientific disciplines. Arriving to the end of the XX Century we observe that science exhibits wonderful accomplishments manifested, in part, by its capacity to lead to technological innovations. But, on the other hand, science shows nowadays a variety of failures. The situations specially difficult to tackle for the scientific research are, precisely, those exhibiting the property called "complexity".

Let us remember here the classical distinction among complexity ranges proposed in 1948 by Warren Weaver, namely, organized simplicity, disorganized complexity and organized complexity. This author calls "organized simplicity" a property of real systems capable to be described using models with a small number of variables that interact in a deterministic (or almost deterministic) way. The systems whose description requires models with a very large number of variables and a high degree of randomness are said to exhibit "disorganized complexity"

We would like to remark that there are situations which show both organized simplicity and disorganized complexity depending on the description level adopted. For instance, the macroscopic description of a gas involves only a small number of non-random variables and, at this level the system shows organized simplicity. In contrast, at the microscopic level its mechanical description would require a huge number of variables with a high degree of randomness therefore showing disorganized complexity.

These two first Weaver's categories recover the areas where science has obtained its most characteristic achievements. But there is a third category of phenomena that Weaver characterizes as presenting "organized complexity". The systems presenting

this type of complexity are, in some cases, too large to be represented by detailed models. In other cases, the description of their dynamics requires the specification of non-linearities which prevents a complete analysis. At the same time, these systems are not random enough to allow the standard use of statistical methods. To this category belong many important biological phenomena that include from the rich variety of interactions of metabolic networks to the complex dynamics of structured biological populations. Here is where science is seriously in need of methodologies.

In the Symposium, our intention was to assemble scientific researchers coming from different areas and whose works are deeply concerned with biological complexity. As complexity shows similar faces in different disciplines we have also promoted the participation in the Symposium of researchers coming from Mathematics and Physics. In addition, both experimentalists and theoreticians were present, since each one of their modes of research can not exist without the other. Favouring such a variety, we intended to contact with "hot" problems coming from the experimental side and, at the same time, to oppose the dangerous tendency (present mainly among some theoreticians) to take transitory solutions of problems as final truths, instead of keeping them open until the time is ripe.

The result of our Symposium is the diverse material present in this book. We hope that this diversity is a good testimony of the vastness and beauty of some of the very complex problems that challenge scientists.

The Editors

Texto de contratapa

The development of instruments for the analysis of complex systems is an enterprise that concerns researchers coming from a large variety of scientific disciplines. Situations specially difficult to tackle for the scientific research are, precisely, those exhibiting the property called “complexity”.

The Symposium on Biological Complexity held in Montevideo in 1995, assembled scientific researchers coming from different areas and whose works are deeply concerned with this subject. As complexity shows similar faces in different disciplines, participation in the Symposium of researchers coming from Mathematics and Physics, was also promoted. In addition, both experimentalists and theoreticians were present, since each one of their modes of research can not exist without the other. Favouring such a variety, the meeting intended to contact with “hot” problems coming from the experimental side and, at the same time, to oppose a dangerous tendency: to take transitory solutions of problems as if they were final truths.

The Symposium was attended by 21 researchers from Argentina, Chile, France, Israel, U.S.A. and Uruguay. This book assembles their papers, together with considerations discussed in a round table, and a closing lecture.