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Preface

One of the ever present *grand challenges* and *central goals* of computer science is to understand the world around us in terms of information processing. Each time progress is made in achieving this goal, both the world around us and computer science benefit.

Nature is a dominating part of the world around us, and one way to understand it in terms of information processing is to study computing taking place in nature. ***Natural Computing*** is concerned with this type of computing and with its main benefit for computer science, viz., human-designed computing inspired by nature. By its very nature, the science of natural computing is genuinely interdisciplinary, and therefore natural computing forms a bridge between natural sciences and computer science. In this way natural computing elevates computer science to an even more prominent role in the broad rainbow of scientific disciplines.

Human-designed computing inspired by nature is based on the use of paradigms, principles and mechanisms underlying natural systems. Some disciplines of human-designed computing are relatively old (in the young history of computer science) and are well established by now. Well known examples of such disciplines are **evolutionary computing** and **neural computing**. Evolutionary algorithms are based on the concepts of mutation, recombination and natural selection from the theory of evolution, while neural networks are based on concepts originating in the study of the highly interconnected neural structures in the brain and the nervous system. On the other hand, **molecular computing** and **quantum computing** are younger disciplines of natural computing: molecular computing is based on paradigms from molecular biology, while quantum computing is based on quantum physics and exploits quantum parallelism.

Natural computing includes many more research areas, e.g., **cellular automata**, **artificial life**, **reaction diffusion computing**, **amorphous computing**, and **immunocomputing**. Also, a lot of research in **bioinformatics** is concerned with natural computing. **System biology** is an example of a recent development in biology that is closely related to natural computing. Here one aims at an understanding of the dynamics of the whole system through an understanding of interactions between its components. These interactions are often considered (especially in **computational system biology**) as computational processes.

Research in natural computing encompasses theoretical, experimental and applied issues, but this journal is concerned with theory. As a matter of fact, the interaction of theoretical computer science and natural sciences dates back to the very beginnings of computer science. Here are just three examples of this interaction.

Some of the most important foundational research in automata theory was inspired by the work of W.S. McCulloch and W. Pitts which considers neurons as binary transmitters of information. The theory of L-systems initiated by A. Lindenmayer was motivated by modelling of development of simple organisms and it had a fundamental impact on formal language theory (as well as significant impact on modelling of plants). The DNA revolution which in the last 50 years had such tremendous impact on biology and many other areas of science (as well as on our everyday's life) had also a big influence on theoretical computer science. For example, the overwhelming success in sequencing of the human and other genomes was to a large extend based on the development of pattern matching and other string processing algorithms. The whole area of design and analysis of pattern matching and editing algorithms benefited enormously from the intense research concerned with sequencing of genomes.

It is quite natural for research in natural computing to see a science fiction idea of yesterday to materialize as a (near) reality of today. This research has already led to a deeper and broader understanding of the nature of computation. We believe that what we witness now is merely the beginning of the development of an exciting area of science. We also

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believe that “Theoretical Computer Science, Series C: Natural Computing" contributes to, and is a valuable record of this development.

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