Preface

Artificial Life, unlike artifical intelligence, had humble beginnings. In the case of the latter, when the word itself was born, the first breathtaking results were already out, such as The Logic Theorist, a computer program developed by Allen Newell, Herbert Simon and Cliff Shaw in 1955–56. In artifical life, for a long while, amibition seems to have dominated over the results, and this was certainly true for the first, formative years. It was a bit unclear what *exactly* Artificial Life is. As not uncommon in science, the first definition was attempted in the negative form, just like when psychology (the study of the mental) was first defined as "anything not physics" (meaning, not natural science) in the nineteenth century. A tempting early definion of Artificial Life was one that distinguished it from theoretical and mathematical biology, modeling, evolution theory, and all the rest of what consituted "an old kind of science" about life. This was not without grounds, perhaps, and the parallel with artificial intelligence comes up again. Artificial intelligence was conceptually based on "machine functionalism," the philosophical idea that all operations, such as the mental operations of humans, are to be captured as "mere functions," or, in other words, as independent of their actual physical realizations. Functionalism has put computers and algorithms in the focus of interest in all dealings with human intelligence, and artificial intelligence was a computerized approach to the mind that was designed to capture human mental operations in the functional sense. Now it was simply the case that the *functionalism of life* was not yet born, and Artificial Life looked like the candidate that was needed for exactly that—to discover how computers can be used to uncover the secrets of life. There were cellular automata, that John von Neumann discovered back around 1950, that are capable of self-reproduction. Perhaps life was just a step away. This and a new fascination with functionalism in Artificial Life put computer scientists (who could technically master cellular automata and computer math) into a central position—in Artificial Life as it could be.

But Artificial Life became different. Incidentally, the slogan "life as it could be" was coined as a motto for Artificial Life, but now the same conditionals apply to Artificial Life itself. The reason is that functionalism turned out to be just one part of the story.

There is a well-known and much used (maybe over-used) phrase in biology, called "Dobzhansky's dictum," which says that "nothing in biology makes sense except in the light of evolution." Evolution is, as rightly captured in the dictum, central to the understanding of all things alive, and hence it is, and this had to be discovered, central to the studies of Artificial Life as well. And soon it also turned out that evolution cannot be readily reduced to algorithmic problems, or and least not in that pure, detached sense as it was attempted in functionalism. Evolution is *complex* in a sense recently acknowledged in the sciences of complexity: there is no single principle, no simple set of rules, and no transparency. Instead, evolution is a combination of many heterogeneous, and sometimes contingent factors, many of which have to do with the complex ways of existence of organisms: their body, their interaction, their development, their geo-spatial relations, their temporal history, and so on. This brought biology and biologists back into the equation, and Artificial Life has greatly benefited from that. Evo-devo (the interplay between evolutionary and developmental biology), evolutionary robotics, or systems biology are examples of fields where mathematical and algorithmic thinking combined with "wet" reality started to produce new and fascinating results. (Those who kept an eye on cognitive science and artificial intelligence found that over all those years a similar process has taken place there as well. *Embodiment*, or situated physical realization, has permeated and changed these fields to the same extent, or even more, as it did Artificial Life).

Today, as a result of these processes, Artificial Life is a prolific field that combines the best of computer science with the best of theoretical biology, mathematical modeling, and simulation. One way to express this is to say "Darwin meets von Neumann" at last—where "real" biology and "pure" function are no longer seen as contradicting, or even complementary. Rather, they permeate and fertilize each other in a number of fascinating ways.

ECAL 2009 was the 10th Europan Conference of Artificial Life, which means 20 years of history. It was an occasion to celebrate the 20 years of development of the field and also the new symbiosis referred to in the title. Famously, 2009 was also "Darwin year," celebrating his 200th birthday and the 150 years of the *Origin of Species*. Thus it was highly appropriate to dedicate the meeting to Darwin—and von Neumann together. Five keynote lectures were delivered by eminent invited speakers, in the order of appearance they were: Peter Hammerstein (Humboldt University, Berlin), Hod Lipson (Cornell), Nick Barton (FRS, Edinburgh), Richard Watson (Southampton) and Eva Jablonka (Tel-Aviv University)—their choice reflected the spirit of convergence alluded to above.

The conference featured 161 submissions, out of which 54 were accepted as talks and 87 as posters (making up a total of 141 presentations). Adopting the recent practice of many science meetings, submissions could be based either on full papers or extended abstracts. The meeting was organized in a single track over three days, with parallel (whole-day) poster sections, to give best visibility to everyone's work. We decided to publish all papers of the accepted presentations, not making any difference between posters and talks. This resulted from different factors: many excellent submissions had to be put into the poster section to keep reasonable time limits for the talks, and often this included second or third papers of some of the key speakers. Poster or talk was therefore not necessarily a quality issue. But also, we decided to publish all poster papers because we wanted to show the heterogeneity and the full spectrum of activities in the field, in order to provide an authentic overview. The result is this volume in 2 parts, containing 116 full papers.

The conference was sponsored by the Hungarian Academy of Science in different ways, one of them the special rates we enjoyed when using the wonderful historical building of the Academy in the very center of Budapest, just across the castle and the Chain Bridge. It is a building with a unique historical atmosphere and one that has seen many major scientific events. The conference talks were held in the Great Lecture Hall, which added to the impression that Artificial Life—and ECAL—are coming of age. The other sponsor was Aitia International, Inc., whose support is gratefully acknowledged. Aitia is the maker of MEME, or Model Exploration ModulE, a platform for DoE (design of experiments) and parameter sweeping, running on a cloud (https://modelexploration.aitia.ai/).

The publication process experienced several unexpected difficulties and delays. The proceedings could never have been published without a final push by Mark Jelasity, of Szeged University, a member of the Local Organizing Committee. It was his support and his offer for a hands-on contribution and equally his expertise of LaTeX and prior experience with Springer LNCS publications that made the essential difference that helped cross the line. Mark was offered but declined to be an Editor, lacking a scientific contribution to this conference and bearing a responsibility for the selection process, and this is a decision we had to respect. Nevertheless, here is a "big thank you," Mark. Several other people provided important help in the production of the volume, of whom Balazs Balint (Collegium Budapest) and Chrisantha Fernando (Sussex) need special mention. We thank the TenSi Congress Ltd. for the seamless technical organization of the meeting. In the evaluation phase, important help was given by several members of the Program Committee and also by additional reviewers, listed separately, whose contribution is highly appreciated. The conference and the proceedings have been the work of several people, and we thank all of them for making it happen. Finally, we thank Anna Kramer of Springer for her support and patience.

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