Preface

Artificial life is an interdisciplinary research enterprise investigating the fundamental properties of living systems by means of the simulation and synthesis of life-like processes in artificial media. Although isolated specialists in different disciplines had worked in this area for many decades, perhaps the first attempt to collect this disparate work and encourage its cross-pollination was the conference on "Evolution, Games, and Learning: Models for Adaptation in Machines and Nature" organized by Doyne Farmer, Alan Lapedes, Norman Packard, and Burton Wendroff in 1985 at Los Alamos. This conference was followed by another two years later, this one organized by Christopher Langton and baptized "Artificial Life." Since then, the name has stuck and the biennial conferences have continued, moving through Santa Fe, Boston, Nara, and Los Angeles, to Portland. The growth of this collective research enterprise over the past decade and a half, spawning a number of professional journals and specialized conference series in Europe and Asia, is nothing short of astounding.

The artificial life community is still strikingly interdisciplinary. This conference, the seventh in the series, includes authors in biology, physics, chemistry, computer science, mathematics, psychology, economics, robotics, information science, physiology, and philosophy. The interdisciplinary nature of artificial life creates special challenges. It is hard to keep abreast of relevant new work when it uses different specialized vocabularies and methodologies and is published in disparate venues, and it is hard to establish and follow high standards of scientific rigor that different disciplines with unique histories and intellectual conventions will each find acceptable. The coincidence of this year's conference with the birth of a new millennium provides a natural opportunity to address these challenges. Artificial life will remain a vital research activity only if we periodically look backward and reassess our work, so we can continually augment a foundation of solid achievements. We must also periodically look forward and identify the most important open questions so that we can promote fruitful research activities and evaluate their progress over time. Looking backward and forward in this way enables us to renew and redefine our interdisciplinary center of gravity and to reshape the direction of future research. Hence, the theme of this year's conference: *Looking backward, looking forward.*

Over a hundred papers were submitted to the conference, and about half of these will be presented as talks. This volume contains all of the papers to be presented as talks, as well as some of the papers to be presented as posters. All of the papers were reviewed by at least three people on the program committee for quality of science, quality of presentation, and relevance to the conference. The papers fall into seven broad topic areas: (1) the origin of life, self-organization, and self-replication, including astrobiology, artificial chemistry, molecular self-assembly, and molecular information processing; (2) development and differentiation, including multicellular development, gene-regulation networks, and morphogenesis; (3) evolutionary and adaptive dynamics, including modes of selection (natural, neutral, kin, etc.), evolvability, and cultural evolution; (4) robots and autonomous agents, including bio-inspired robots, autonomous and adaptive agents, and evolutionary robotics; (5) communication, cooperation, and collective behavior, including the evolution of social, linguistic, economic, and technical systems; (6) methodological and technological applications, ranging from commerce and industry to medicine; (7) and the broader context, including discussion of the historical origins of artificial life, philosophical analysis of artificial life's distinctive methodologies, and connections between artificial life and artistic creativity.

Creating this conference has crucially depended on many co-organizers. I am especially indebted to my co-editors and Program Committee Co-Chairs: John McCaskill, Norman Packard, and Steen Rasmussen. Their excellent scientific judgment coupled with their hard work and generous spirit made the process of shaping the scientific character of this conference especially rewarding and inspiring. The blizzard of activity that has culminated with this volume has depended on the good

will, boundless energy, and technical wizardry of one person more than any other: our Technical Secretary, Titus Brown. Kathleen Stackhouse and Eilis Boudreau admirably oversaw the hundreds of details involved in the conference's local arrangements. Eilis Boudreau and Carlo Maley, Workshops and Tutorials Co-Chairs, shouldered the responsibility for overseeing more than a dozen special-interest gatherings at the conference and producing the *Artificial Life VII Workshops Proceedings*. These workshops and tutorials add immeasurably to the value of the conference experience. Tracy Teal, conference Webmaster, cheerfully and capably created our conference web pages and updated and revised them, sometimes on a daily basis. Ken Willett, conference Treasurer, helped the conference get off on a sound financial footing by preparing and revising our budget. And Peary Brug has helped raise additional support for the conference.

Many people at Reed College made invaluable contributions to the conference. Dean of Faculty, Peter Steinberger, provided crucial early support. Aurelia Carbone created the beautiful conference poster. Mike Raven helped with technical trouble-shooting. And the staffs in the Business office, the Computing and Information Services, the News and Publications office, the Conference and Events Planning office, and Food Services created a wonderfully constructive and cooperative community for organizing the conference.

A very warm thanks is due to all our sponsors, especially Reed College and Intel Corporation, whose early financial support made this conference possible at all. My warm thanks also go out to Bob Prior at MIT Press for his continual support of the artificial life conferences. I am grateful to all my colleagues who agreed to serve on the conference's international Scientific Advisory Board: David Ackley, Chris Adami, Rik Belew, Hughes Bersini, Maggie Boden, Sung-Bae Cho, Dario Floreano, Stephanie Forrest, Inman Harvey, Paulien Hogeweg, Phil Husbands, Tashaki Ikegami, Kunihiko Kaneko, Jozef Kelemen, Christopher Langton, Ju-Jang Lee, Maja Mataric, Jean-Arcady , Melanie Mitchell, Domenico Parisi, Jordon Pollack, Tom Ray, Mitchel Resnick, Masanori Sugisaka, Luc Steels, Charles Taylor, Jon Umerez, Stewart Wilson, Yong Guang Zhang. And a very special thanks goes out to all my colleagues who carefully reviewed the papers submitted to the conference: David Ackley, Chris Adami, Wolfgang Banzhaf, Hugues Bersini, Eric Bonabeau, Sung-Bae Cho, John Collier, Michael Conrad, Michael Dyer, Emmeche, Dario Floreano, Robert French, Inman Harvey, Paulien Hogeweg, Phil Husbands, Takashi Ikegami, Norman Johnson, Kunihiko Kaneko, Brian Keeley, Marc Lange, Kristian Lindgren, Carlo Maley, Paul Marrow, Barry McMullin, Filippo Menczer, J.J. Merelo, Jean-Arcady Meyer, Alvaro Moreno, Chrystopher Nehaniv, Stefano Nolfi, Charles Ofria, Domenico Parisi, Tom Ray, Craig Reynolds, Moshe Sipper, Eugene Spafford, Russell Standish, Luc Steels, Chuck Taylor, Tim Taylor, Guy Theraulaz, Adrian Thompson, Mark Tilden, Jon Umerez, Barbara Webb, Michael Wheeler, Claus Wilke, and Andy Wuensche. The intellectual integrity of a field is protected by the diligence and good judgment exercised by those who participate in the peer review process; we all owe them our appreciation and thanks.

Finally, on a personal note, I want to express my warmest thanks to Kate O'Brien, whose sound instincts, balanced judgment, and positive outlook make her such an extraordinarily valued companion in this and all other aspects of life.

Mark A. Bedau
Conference Chair, Artificial Life VII

Portland, April 2000