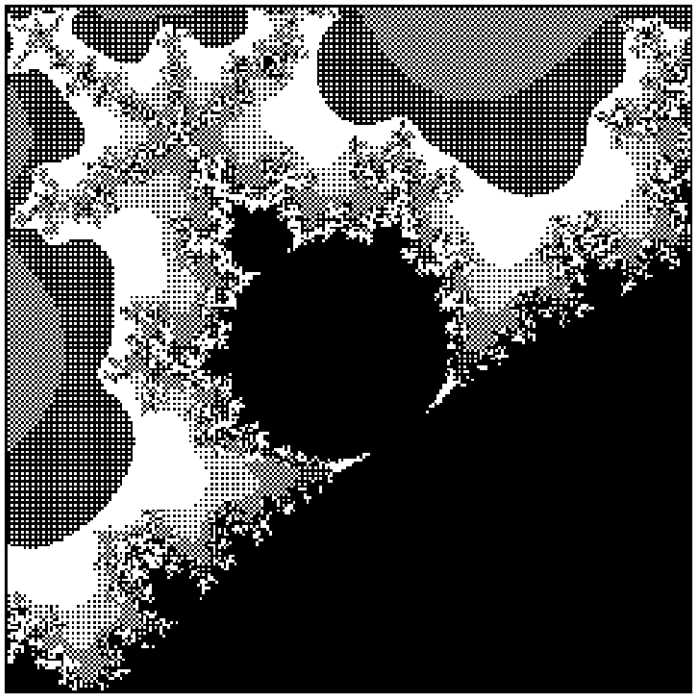
Education in the Systems Sciences

An Annotated Guide
to Education and Research Opportunities
in the Sciences of Complexity

Winter 1990



Blaine A. Snow

Education in the Systems Sciences

An Annotated Guide
to Education and Research Opportunities in
the Sciences of Complexity

Cybernetics
General Systems Research
Self Organization
Dynamical System Theory
Chaos Theory

First Edition
Winter 1990

Blaine A. Snow

with
Fritjof Capra and Heinz von Foerster

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Preface

by Heinz von Foerster

Language is not to be understood
but to make understood that
which is neither language nor understood.

Herbert Brün[*]

Here it is: The Annotated Guide for finding one's way through the labyrinth of books, journals, people, places, programs, scholars, schools, and other water holes where the potential student of cybernetic and systemic wisdom may quench her or his thirst for some specific, mundane, or esoteric knowledge.

Such a guide is needed, for the "Sciences of Complexity," as our author calls the universe of concerns in this guide's subtitle, are not easy to come by: the nature of complexity lurking behind all scientific thought was until recently carefully hidden from our sight. By opening the doors to this epistemological closet the skeletons are now allowed to rattle in the open.

Why bother?

Why contemplate complexity at all when we have Ockham's Razor with which to shave off all superfluous sprouts that unnecessarily complicate an issue, when we have Orthodoxy's Reductor that chops an unwieldy problem into ever smaller pieces until they are small enough to be understood? That is, he who still talks "complexity" demonstrates his incompetence in using these tools of simplification.

But we have seen, for instance in family therapy, that the so called "identified patient" is very often the only sane kid on the block, and we begin to see that very often the discarded shavings were the essentials, and the cut connections between parts are the essence that constituted the very object of our inquiry.

Since this permeates all sciences, the sciences of complexity are transdisciplinary. Transdisciplinary in the sense that a discipline requires an understanding of a particular subject matter, interdisciplinary that of some others as well; transdisciplinary, however, suggests an understanding of understanding per se.

Blaine Snow, in this guide through a forest of educational and research opportunities in the sciences of complexity , extends to you an invitation (p. 15) to help us all with your comments, suggestions, corrections, extensions, etc., to facilitate our understanding of complexity, and, finally, of ourselves.

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[*] Herbert Brün: #36 in my words where i want them, princelet edition, London (1986).

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Introduction

This guide brings together information on the broad spectrum of education and research opportunities currently available in the sciences of complexity. Its purpose is to make these kinds of investigations more accessible by providing information on programs, institutions, organizations, and literature where one can learn about their principles, methods, and applications. The guide is intended to help interested students and educators locate the various academic fields, departments, institutes, and programs that offer education in systems thinking and complex systems research. The guide may also serve professionals who are already involved in the systems sciences as a directory to general activity in what are otherwise widely separate fields. By browsing the guide one can get a quick sense of where education and research in systems science is going on in both North America and Europe.

The need for such a guide is primarily due to the interdisciplinary nature of systems science and its non-departmental character. Systems thinking and studies of complex dynamical systems are applicable to practically every area of investigation and can thus be studied through widely separate disciplines. Consequently, someone interested in systems thinking and in learning more about the sciences of complexity is not easily led to places where they are taught. While many diverse disciplines are engaged in complex systems research of one sort or another, the average student or professional wanting to learn more confronts the problem of it being, in a sense, nowhere in particular but everywhere in general. Thus another aim of this guide is to help unite this diverse activity; activity in which a broad and diverse collection of professional men and women are engaged, in the words of Ilya Prigogine, in a period of scientific revolution, one in which the position and meaning of the scientific approach are undergoing reappraisal.[1]

A. Background

This guide to education in the systems sciences represents the beginnings of the first systematic investigation of graduate education and research activity in the sciences of complexity. It is the result of the Systems Education Research project initiated by Dr. Heinz von Foerster, professor Emeritus of the University of Illinois and a veteran of cybernetics and the systems science movement, and Dr. Fritjof Capra, physicist and author of books on new thinking in the sciences and its effect on perception and societal change. The acquisition of information for the guide as well as its structure and content, are all my own labors carried out over the last two years.

An initial list of degree-granting programs was generated from responses to 190 inquiries sent (Dec. 87) to attendees of the 1986 Gordon Research Conference and the 1986 meeting of the American Society for Cybernetics. This information was supplemented by extensive library research, including database keyword searches, combing through reference materials, directories, books in the field, and hours using the Career Guidance Foundation's *College Catalog Collection* on microfilm. Once a skeletal list had been assembled, additional letters of inquiry were sent out during 1988 to those whose names had so far been collected. New information from that mailing was added, phone contacts were made, and information slowly accumulated.

The subject of education in the systems sciences in order to further systems thinking and the systems approach has been the topic of several conferences, papers, and books over the years. Several lists of education opportunities in the systems sciences have been initiated by these activities and assembled by various people in the past, although none seem to have developed to the point of publication. One such list of systems education opportunities was made a few years back by Dr. William Reckmeyer of San Jose State University. Dr. Reckmeyer's original list, which appears (in part) as "The Current Nature and Scope of Systems Education: A Review" in the book *Systems Education: Perspectives, Programs, and Methods*, edited by Bela Banathy,

[1] Prigogine, Ilya. *From Being to Becoming: Time and Complexity in the Physical Sciences*. New York: W. H. Freeman and Co., 1980, pp. xii-xiii.

was assembled around 1980 and contains a selection of seventy different places where general systems research and cybernetics are taught. Dr. Reckmeyer's collection is probably the most extensive to date and he has been kind enough to share some of his research for this guide. Dr. Martin Zwick of the Systems Science Ph.D. program at Portland State University and Dr. Len Troncale, director of the Institute of Advanced Systems Studies at California State Polytechnic, both generously provided information on systems science programs for the guide and helpful discussion over the phone. Similar unpublished lists no doubt exist elsewhere in systems science departments, or are maintained by the various systems science societies. Every attempt is being made to acquire any new information for this guide. (See section E, p15, below).

B. Nature of the Contents

What fields of science does this guide cover? Unfortunately there is no easy answer to this question. Simply stated, this guide includes education opportunities in a group of related disciplines that have been known in the past as "systems sciences," and known more recently as the "sciences of complexity." This guide contains information on various ways and places one can get an education in these disciplines, and acts as a sort of handbook to these somewhat obscure and esoteric scientific activities.

Because of their recent appearance and their highly interdisciplinary nature, the sciences of complexity are difficult to frame in the language of traditional disciplines. As a start, the 1980 HEGIS Taxonomy describes the academic discipline of systems science as follows:

> 30.0601 **Systems Science**: An instructional program that describes a *multidisciplinary* approach to the study of *innate complexity* which by *synthesizing systemic* findings from the natural, social, technological, behavioral and life sciences, and other specialized fields brings *holistic* perspectives to the solution of problems within a general context [italics mine to show keywords].

However, systems science is not the 'study of everything' as the word "systems" might suggest. George Klir pointed this out by citing the distinction Ross Ashby made in his book *Introduction to Cybernetics* between a) *an object*, loosely understood as a part of the world in which someone is interested, and b) *a system defined on the object.* Thus quoting from Ashby:

> "At this point we must be clear about how a 'system' is to be defined. Our first impulse is to point at the pendulum and to say 'the system is that thing there.' This method, however, has a fundamental disadvantage: *every material object contains no less than an infinity of variables and therefore of possible systems.* The real pendulum, for instance, has not only length and position; it has also mass, temperature, electric conductivity, crystalline structure, chemical impurities, some radio-activity, velocity, reflecting power, tensile strength, a surface film of moisture, bacterial contamination, an optical absorption, elasticity, shape, specific gravity, and so on and on. Any suggestion that we should study 'all' the facts is unrealistic, and actually the attempt is never made. What is necessary is that we should pick out and study the facts that are relevant to some main interest that is already given. . . .The system now means, not a thing, but a list of variables."[2]

Says Klir: "Confusions arise when [this distinction between object and system] is not recognized and, as some critics suggested, systems research becomes then the study of everything (every object) and is thus logically empty."[3] That this fundamental distinction is all too easily forgotten is largely due to being surrounded by a language and world organized around nouns, things, and objects. Systems science looks more to verbs, to active relationships between things—with less regard to material

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[2] Ashby, W. Ross. *An Introduction to Cybernetics*. New York: Methuen, 1956, p. 39, 40.

[3] Klir, George J. Foreword to *Mechanisms of Intelligence: Ross Ashby;s Writings on Cybernetics*, edited by Roger Conant. Salinas, CA: Intersystems, 1981, p. ii.

objectivity—and is therefore essentially a functional and behavioristic science. "Cybernetics," says Ashby, "...treats not things but *ways of behaving*. It does not ask 'what is this thing?' but *'what does it do?'*. Thus it is very interested in such a statement as 'this variable is undergoing a simple harmonic oscillation,' and is much less concerned with whether the variable is the position of a point on a wheel, or a potential in an electric circuit."[4] These descriptions of the systems approach by Ashby and Klir make clearer the character of the fields of research that are represented in its many forms in this guide.

The earliest systems sciences—General Systems Research, Cybernetics, and their related disciplines—have had established societies and academic programs the world over for many years and are thus most represented in this guide. In addition to education opportunities in general systems research and cybernetics, the guide is also concerned with the new and expanding research activities in the theory of complex dynamical systems—investigations often identified by such words as "self-organization," "dissipative structures," "synergetics," "chaos" and "strange attractors," "fractals," "nonlinearity," "nonequilibrium," "parallel distributive processing," "autopoiesis," and others. Although much of this research is very new and thus hasn't yet become an established part of academic programs, the guide includes information on institutions, people, and programs that pertain to such investigations. With the rise of complex dynamical systems research in the last twenty years or so, and most recently in this decade with the science of chaos, these investigations along with other strands of research have come together to be known collectively as the sciences of complexity.

For the purposes of this guide these sciences of complexity can be identified by the fuzzy categorizations offered below. Each of these categories interlocks with one or more of the others in ways that make clear distinctions between them all but impossible. As is, the categories offered more or less represent *groups of related disciplines* based on *a spirit of scientific research* that has been established (and in some cases evolved over a period of years) by *interdisciplinary groups of scientists* brought together by their *interest in exploring the invariant aspects of complexity and systemicity outside the constraints of departmental boundaries*. Each of these sciences can be viewed from many angles; one angle would reveal ties to a traditional field or fields of study, another angle would reveal a certain shared epistemological point of view, another would reveal historical influences of new discoveries and new technologies, and yet another would reveal a science inspired by the definitive work of a few individuals. These new sciences do not connect the whole of one traditional discipline with another but rather assemble particular subfields to form a new subject. (The following is not intended as a complete list of systems sciences nor as any best way to categorize them; further and more detailed distinctions are possible. Overlap occurs throughout the list.) These new sciences are as follows:

From the late 1940's (and before) emerged the earliest sciences dealing with complex system behavior, they are:

1. **Cybernetics** and its related disciplines: the science of effective organization, *irrespective of material realization;* investigates variety, information and control, circularity and recursion, process, adaptation and evolution, observation and decision making in a) observed systems (first-order cybernetics), and in b) observing systems (second-order cybernetics). Has affected many fields of study including the cognitive and behavioral sciences, family therapy and psychiatry, communications and electrical engineering, management science, computer science, education, ecology, economics, and political science.
2. **General Systems Research** and its related disciplines; encourages development of theoretical systems which are applicable to more than one of

[4] Ashby, W. Ross. *An Introduction to Cybernetics*. New York: Methuen, 1956, p. 1.

the traditional departments of knowledge, investigates the isomorphy of concepts, laws, and models in various fields and helps in useful transfers from one field to another, encourages development of adequate theoretical models in fields which lack them, minimizes duplication of theoretical effort in different fields, promotes the unity of science through improving communication among scientists. Related are Bogdanov's "tektology" and the holism of J. C. Smuts. GSR has affected many fields of study including management science, family therapy and psychiatry, education and educational technology, theoretical biology, ecology, economics, urban and environmental design, and policy studies.

Studies of self-organization in nonequilibrium systems represents another important area of complex systems science coming much from research in areas such as physical chemistry, fluid dynamics, and biophysics and closely relates to the most recently developed sciences of complex dynamical systems and chaos research,[5] thus:

3. **Nonequilibrium Self-Organization Research:** includes studies of self-organization and complexity in nonequilibrium systems; the science of synergetics (Haken), dynamical systems theory, non-equilibrium thermodynamics, dissipative structures, nonlinear and irreversible phenomena, fluid flows and turbulence, autowaves, macrostructures, evolution and adaptation, etc. in the Mathematical, Physical, Natural and Social Sciences.
4. **Chaos and Complex Dynamical Systems Research:** includes studies in chaos theory, nonlinear phenomena, dynamical systems, strange attractors, topology, catastrophe theory, fractal geometry and iteration theory, Verhulst dynamics, self-referential systems, etc. in the Mathematical, Physical, Natural and Social Sciences.

These first four traditions of research have formed much of the theoretical framework within which the following traditional fields have drawn from and built upon thus becoming systems sciences themselves in many respects:

Several of these post-World War II fields have contributed much to the development of the study of complexity. Among the more important of the closely-related products of Information Age complexity are computer systems, information and communication systems, and business and management systems. Engineering and management science have played important roles in the development of complexity studies and thus one can speak of systems engineering and systems management as sciences of complexity in their own right. Although computer science is not strictly a systems science, the computer is integral to studies of complexity in all fields, thus:

5. **Systems Engineering and Systems Design**: studies in the design and control of large-scale complex technological systems in various engineering fields, esp. electrical engineering: communications, bioelectronics, power systems, control systems; includes studies of networks, control theory, information theory, communication theory, finite-state systems, mathematical programming, system theory, and large-scale systems; other areas of systems design and architecture include studies of urban, technological, and environmental systems.
6. **Systems Management**: studies in the management of large-scale complex organizations in business, industry, and government—organizations that include people, machines, materials, and information, and the interaction of such systems with their environment; includes self-organization, systems analysis, operations research, queuing theory, network analysis, decision

[5] The distinction largely rests on the differences between the tradition of research established by Ilya Prigogine, Hermann Haken and their schools, i.e. #3, and the tradition of research established by the "chaos researchers," #4. Overlap, however, unaviodably exists.

theory, optimization analysis, organizational behavior studies, autopoiesis, etc.

7. **Computer and Information Sciences**: within computer science are a wide array of complex systems studies involving computational simulation, modelling and imaging; studies of cellular automata, artificial intelligence, artificial life simulation; systems analysis, optimization modelling, numerical analysis, statistics, complexity, theory of computation, computer architecture and machine organization, computer graphics, data base management systems, formal languages and automata theory, information theory, etc.

Another field, cognitive science, has developed side by side with systems science in many ways during the last few decades, and has been especially close to cybernetics and computer science. Gaining a better understanding of cognition has been a central concern among many systems researchers. Many who have contributed most to the sciences of complexity are those who have sought to understand cognitive systems, thus:

8. **Cognitive Science:** within the immense field of cognitive science are a wide array of complex systems studies in neuroscience, artificial intelligence, and behavioral science; also in anthropology, psychology, linguistics, and philosophy; including the connectionist point of view in artificial intelligence, studies of learning and pattern recognition systems, research in parallel distributive processing, self-organization in neural networks, cellular automata, autopoietic systems theory, etc.

Drawing from theories of cognitive systems is yet another important field of study that has contributed to our understanding of system dynamics and organization: systems therapy. The family therapists in particular, through extensive clinical research, have made important contributions to our understanding of how human systems function and how disorders such as schizophrenic and addictive behaviors arise in the context of human relationships.

9. **Systems Therapy:** studies in human relationships; esp. family and marital therapy drawing from cybernetic models of human relationships, including Bateson's philosophy of mind, Maturana's theory of cognition, clinical methods of Michael White, and a systems approach that sees each afflicted individual as an integral part of a inseparable whole.

Finally, the science of ecology by its very nature is a systems science although it is not normally so considered. Systems ecology in the broader sense has become the general study of functional interrelations between natural systems, and between the natural environment and human systems. Ecology has also contributed much to our understanding of system behavior:

10. **Systems Ecology**: studies of relations and patterns between organisms and their environments; the study of the structure, function, and evolution of ecosystems; includes population dynamics, biogeochemical cycling, energy system dynamics and complexity theory, self-organization, etc.

One can see that subjects of study united by complex systems research stretch far and wide; they include global politics, the economy, forest and marine ecosystem dynamics, the weather, the immune system, brain structure and function, neural networks, urban development, the family, corporate management, prebiotic evolution, protein chemistry, turbulence, artificial intelligence, and the learning process to name a few. Most of the people involved in complex systems research are working from within one or more traditional fields; there are mathematicians, physicists, chemists, biologists, ecologists, cognitive scientists, sociologists, anthropologists, therapists, psychologists, managers, economists, computer scientists, architects, engineers,

philosophers, and so on, each who are contributing their expertise towards understanding complex dynamical systems and their behavior.

As a whole these multidisciplinary sciences represent *a new synthesis* in modern science, the dimensions of which we are only beginning to understand. A brochure of the Santa Fe Institute, a recently formed education and research institute whose purpose is to further our knowledge of complex systems, describes this activity as a scientific revolution: "Science is on the threshold of a high stakes effort to extend the frontiers of knowledge. Vast and energizing changes are in prospect that are likely to have a profound effect throughout society. These will have an impact not only on the conceptual base of science, but also on our industries and financial institutions, on our universities and research centers."[6] The sciences of complexity represent a major movement afoot that is prompting many to take a new look at the worldview of modern science and how our knowledge is ordered and divided. As well they are adding exciting new findings to our knowledge of nature, culture, and mind.

It is beyond the scope of this publication to go into the details of the structure and significance of the sciences of complexity. Such an exposition would require one or more volumes on the history and current state of contemporary science and philosophy in light of these sciences.[7] However, for the purposes of this guide we can identify some of their recurrent themes. The sciences of complexity or systems sciences are characterized, among other things, by the following:

- **multi- or interdisciplinary interaction**;
  many fields working together across traditional departmental boundaries; includes cooperation among the mathematical, physical, and biological sciences, social sciences and humanities, and the behavioral and cognitive sciences in solving problems common to complex systems. In many instances, as von Foerster mentions in the preface, they are *trans*disciplinary, that is, going beyond the mere understanding of a subject to investigate the nature of understanding itself.

- **complexity and systemicity**; multiplicity, variety;
  the study of systems; the study of *complexity* in or of systems; usually dealing with *large numbers of variables* that are often defined on a large number of objects, parts, elements in interaction with each other and their external environment.

- **nonlinearity and chaos**; indeterminacy, unpredictability;
  most complex systems display a high degree of nonlinearity; i.e. most phenomena in the natural world require the use of *nonlinear equations* for their description. The nonlinear elements of a system make its future states highly unpredictable, and the discovery of chaos in nonlinear systems has more or less shattered the ideal of classical determinism.

- **temporality and evolution**; process and function, irreversibility, dynamics;
  the effects of time, change, process, and evolution are a central theme; most complex systems appear as *a dynamic set of coherent, evolving, interactive processes* which temporarily manifest in globally stable structures; they are unlikely to have clearly defined states of stability but rather multiple possible states of equilibrium. Time and irreversibility appear to be fundamental to our understanding of the world in every arena, a fact that has brought *process philosophy* to the forefront of discussion. In fact, it is now possible to advance *a general theory of evolution* for systems of all kinds

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[6] "The Future of Science and Society." A publication of the Santa Fe Institute, 1120 Canyon Road, Santa Fe, NM 87501.

[7] For a more detailed view of the new synthesis see: David Pines, ed.; *Emerging Synthesis in Science*. New York: Addison Wesley, 1988. For those who want a better picture of how the sciences of complexity are changing the worldview of modern science, there are several non-technical introductory books suggested in bold type in section 7.

based on recent developments in the empirical sciences and sciences of complexity.[8]

- **far from equilibrium conditions**; open systems;
  most of the phenomena under study are *open systems*, that is, they exhibit a partial openness by means of a constant exchange of matter and energy with the environment, a state that, under the right conditions, can preserve order within the system, and a state that can only be maintained when the system is far from equilibrium.
- **network or parallel interaction and structure**; interconnection;
  complex systems are often characterized by a *parallel network structure*; with a *high degree of connections* between units; the brain perhaps being the most perfect example of a highly interconnected parallel network.
- **circularily**; feedback, recursion, iteration, self-similarity, self-reference;
  a recurrent theme in many of these sciences is some form of cyclic, recursive, or self-referential process; these include feedback loops and *circular causal processes of all kinds*, reiterative processes such as in the generation of fractal boundaries, the self-renewing and self-referential process of living things known as autopoiesis, and the circularity that appears in theories of self-reference in cognitive organization.
- **wholeness and self-organization**; emergence, connection, synthesis;
  wholeness, the attribute of a system to display behaviors or properties that are not derivable from the properties or structures of its constituent parts, is another characteristic of multivariable systems; self-organizing systems display holistic behaviors, sometimes called the *emergent properties* of the system. The presence of nonlinearity in a system makes it virtually impossible to understand the system by analysis of its parts; consideration of the whole is therefore practically a requirement in the study of nonlinear phenomena. Currently there exists a move away from a complete reductionist approach toward a more *balanced whole/part description* of complex system interaction.
- **non-materialistic**; focus on information, communication, and organization;
  generally, the principles of complex systems behavior apply regardless of the system's material realization; as we said before, a system is seen as a list of variables, not as an object or thing. With the attention on "systems," there is a corresponding *focus on the non-material domain of information and entropy*, control and communication, order, organization, pattern, and relations, information flow and exchange, coding, epistemology, etc. and the laws derived from them, sometimes collectively referred to as *the physics of information*.
- **observation and epistemology;** thought and decision making processes;
  the role of the observer who knows, thinks, and decides, often plays an important part in the study of complexity. Cybernetics in particular pays close attention to the critical process of conscious observation; "Observation including decision making is the process underlying cybernetic theories of information processing and computing. By extending theories of self-reference to processes of observation including cognition and other manifestations of intelligence, cybernetics has been applied to itself and is developing an *epistemology of systems* involving their observers (second-order cybernetics) qualitatively unlike the earlier interest in the ontology of systems which are observed from the outside (first-order cybernetics)."[9]

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[8] Laszlo, Ervin. *Evolution: the Grand Synthesis*. Boston: Shambhala, 1987.

[9] Quote taken from a definition of "cybernetics" in Krippendorff, Klaus: "A Dictionary of Cybernetics." Publ. by American Society for Cybernetics, p. 20.

- **the computer and the computational viewpoint**;
  with its powerful ability to simulate and model complex systems, the computer is *the primary research tool* of the sciences of complexity. Following from the almost universal employment of the computer in contemporary science comes a corresponding computational viewpoint; much research has come to rely on computational simulation, including research the mathematical, physical, and biological sciences.[10]

Most of these themes are closely related and mutually supportive, and collectively they represent an altogether new orientation in scientific research. These and other themes are present to some degree in most of these sciences and more or less represent the nature of the contents of this guide. Some systems sciences will exhibit one of these features more than another, or will just naturally be oriented toward one of them; they aren't all necessarily present in any given case.

These are the features or themes that formed the general guidelines for the kind of research and study represented in this guide. This guide seeks to bring education in these interdisciplinary fields together for the benefit of students wishing to learn more, and for the benefit of professionals wishing to get a better handle on this diversity of activity. The guide is particularly interested in people, programs, institutes, or organizations that seem interested in or occupied with addressing problems specific to the unification of knowledge across the traditional disciplinary divisions. The guide is most interested in the kinds of education and research that are contributing to this new synthesis in modern science. Indeed another of its purposes is to support and encourage these activities.

C. Selection Process: to Include or Not to Include?

How was it decided on what will and will not make it into the guide? I realize how immense an area the sciences of complexity cover and the guide makes no claims to be representing the greater part of it, especially on the present budget. There is no doubt that there are programs, departments, institutes, and people that have so far been missed and and should be included. The collection of information goes on constantly and new information is continually added and will appear in subsequent editions of the guide. If you or your program, institute, etc. have been missed or know of others who have been overlooked, please complete one of the feedback cards provided and send it to: Systems Education Research, 8111 Ellison NW, Olympia, WA 98502.

The most challenging aspect of assembling this guide has been arriving at a working definition of "systems science" and "the sciences of complexity" in order to establish objective selection criteria. Given the complexity of modern science in the late 1980's and its rapid state of evolution, it has been relatively impossible to develop any such definition that is satisfactory. As much as I tried to standardize selection procedures, the choice of entries in the guide was ultimately intuitive and arbitrary. There is, however, some method to the madness. Due to the situation I employed general guiding principles rather than well defined criteria, among them being:

- focus mainly on graduate education but don't exclude undergraduate programs if they seem appropriate.
- do not exclude a program because it is not offered in a traditional university; include all public, private, government sponsored, or non-institutional kinds of education if relevant to systems science study.
- be open to what constitutes a "program" or "course"; include departmental as well as cluster courses.

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[10] For a broader view of the role of the computer in the sciences of complexity see: Pagels, Heinz. *The Dreams of Reason: The Computer and the Rise of the Sciences of Complexity*. New York: Simon and Schuster, 1988.

- don't include single courses that haven't any connection with a larger program or course of systems study.
- include recommendations offered by professionals in the systems fields unless they are found to have little or no relation to complex systems studies.
- exclude those activities that use "systems" in their description but are found to have little interest in, or don't seem to be contributing to the larger scope and development of the sciences of complexity.
- use central keywords[11] found in descriptions of programs, institutes, etc. as an indicator of involvement in complex systems education and research.
- go by the list of characteristics (given above) to determine the general degree or extent a given program, department, institute, organization, etc., seems involved in complex systems education and research.

The last two guiding principles were most employed in identifying new information for the guide. The determining factor in many of the entries was the kind of language used in their descriptions. Keywords played a central role. It was usually keywords and general language usage that allowed me to identify characteristics common to the sciences of complexity and thus designated a given program, department, institute, etc. for inclusion in the guide.

Admittedly it is not possible to list all institutes, programs, and people that are involved in complex systems education and research in one way or another, and thus most entries in the guide are those that incorporate a substantial amount of systems thinking and methodology into the curriculum; thus single, stand-alone courses had to be excluded. There are complex dynamical systems studies going on at most major universities, in many departments, by many theorists, and as far as it is possible the guide will list those institutions and people that seem most active in this kind of research.

D. Overview of the Guide

The pedagogical point of view this guide takes is that schooling represents only a part of one's education. Therefore academic programs and coursework are only one part of this "handbook" to education in complex systems science. In addition to Section 1 listing Programs of Study, several sections are included which list things relevant to education in the systems sciences that are not strictly academic programs. Section 2 lists Research Centers and Section 3 lists Societies and Associations. Often research institutes and societies will sponsor short courses, summer schools, workshops, symposiums, and the like, designed to further education in a certain area. Section 4 is a first attempt to list information on various people involved in complex systems-related work and research, people who are not necessarily connected with a given institution; information that will be added as it is collected. Two reference sections are included to aid those not familiar with the vast literature in the sciences of complexity; and Section 5 lists periodicals and Section 6 a selection of books. In the future, we hope to also include a section containing a glossary of terms plus a deeper and broader discussion of the nature of complex systems research. Altogether this information should direct the user toward the kind of learning he or she is looking for in complex systems science.

Two indexes exist to help in locating specific information. The **Subject Locator Index** appears at the beginning of the guide and is a tool designed to help one locate a particular subject area that deals in complex systems science. The Subject Locator Index catalogs by subject the entries in Section 1 on Programs of Study: Degree-Granting Institutions, and Section 2 on Research Centers. At the back of the guide is the Name Index which lists alphabetically all entries in sections 1, 2, and 3.

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[11] Please refer to Keyword and Word Cluster Index at the back of the guide for a listing of the central keywords used.

In all cases for the annotations I have allowed the institution or organization to speak for itself by using language that is contained in their own published literature, or in the case of societies and research centers by quoting a description straight from published directories. I invite those who are already listed, as well as prospective entries to the guide, to send whatever they would like to say about themselves for the guide to the address given below.

As this guide is the result of an ongoing research project, information is continually being collected, verified, and added. Future editions will be more comprehensive as funding and other forms of support become available. Entries marked with an asterisk (*) in the guide are still under the process of verification as to what extent systems-theoretical concepts are incorporated into their curricula or, in some cases, to verify whether or not they still exist. As it now stands, the guide reflects many of the most well-known programs, institutes, and organizations that offer graduate education and research opportunities in the sciences of complexity in North America and to some extent Western Europe. Information on European programs, institutions, and people is less complete because of a present lack of contacts and references.

E. Call for Participation

Your help is requested, especially if you are presently active in any way with the education and research concerns of this guide. **Feedback** of any kind—corrections, additions, suggestions, criticisms, etc.—would be greatly appreciated and will help maintain the guide allowing it to better reflect education and research activity in the sciences of complexity. Please inform us by using the response cards attached to the middle of the guide. Kindly send any other correspondence to:

Systems Education Research
8111 Ellison NW
Olympia, WA 98502

With the assistance of many we can build up a truly comprehensive directory of education and research activity in these critically important areas of scientific study and make it available for a minimal price.

The guide will be made available to a wide array of students, educators, and professionals through announcements in relevant journals, at conferences, through societies and associations, and by mailings. Copies of the guide can be ordered either from the address above or from the publisher: The Elmwood Institute, P.O. 5805, Berkeley, CA 94705. There are plans in the future for information contained in this guide to be made available on a relational data base accessible to anyone with a terminal or PC equiped with a modem.

Since this guide is a first attempt at capturing a multitude of scientific activities which, in many minds, comprise a revolution within the whole fabric of modern science, it will necessarily present only a partial picture. Indeed it represents only the tip of the iceberg of activity in the sciences of complexity. Further editions are scheduled that will more accurately and more completely reflect education and research activities in the sciences of complexity. Any errors or misrepresentations that remain are due to my oversight are none other than my responsibility. Our hopes are that this first edition of the guide provides students, educators, and professionals with a better idea of where contemporary systems thinking and complex systems research is taught and practiced.

Blaine A. Snow
Olympia, Washington
January 1990

Education in the Systems Sciences

Subject Locator Index

DESCRIPTION: This Locator is a tool designed for finding systems science programs in a certain subject area or field of study, or for finding a program that emphasizes a certain broad area of study over others. This index does not attempt to classify the institutions and programs offered in any specific way but rather intends to *serve as a general pointer to subject areas.*

Subject headings were generated from the names given by the institution to its programs and departments and how it characterized these through the wording contained in their own published literature. In many cases institutions appear in more than one of the subject headings. Also, there will be instances where a given institution includes a field of study in its curriculum but that institution is not listed under that subject heading (i.e. field) in the locator index. This margin of error is inevitable as my information is limited.

This Locator indexes by subject all entries in the following sections:

1. **Programs of Study: Degree-Granting Institutions**. Programs in this section will be found by first identifying the institution name in the Locator, then looking it up under the institution's name listed in this section.
2. **Research Centers**. Research centers are listed by *the name of the center* rather than by the institution they are associated with. As many research centers have associated programs of study within their respective institution, also offering workshops, short courses, etc., they are also listed as educational facilities and thus indexed here.

To eliminate any ambiguity, numbers 1 or 2 are used to designate which section is referred to. Subject headings to be found in the Locator are as follows:

Biological Systems: General

AUSTRIA
Institute for Theoretical Biology:Univ. of Vienna (2)
GERMANY, WEST
Max Planck Institute of Behavioral Physiology (2)
Max Planck Institute for Biological Cybernetics (2)
Max Planck Institute for Biophysical Chemistry (2)
NETHERLANDS
Institute for Theoretical Biology (2)
POLAND
Institute of Biocybernetics and Biomedical Engineering (2)
USA
Biotechnology Laboratory: Univ. of California, Los Angeles (2)
California State Polytechnic University, Pamona (1)
Complex Systems Research Center: Univ. of New Hampshire (2)
State University of New York, Systems Science (1)
Systems Science Institute: Univ. of Louisville (2)

Biophysics

BELGIUM
Free University of Brussels (1)
WEST GERMANY
Max Planck Institute for Biophysical Chemistry (2)
University of Stuttgart (1)
USSR
Institute of Biological Physics (2)
USA
Santa Fe Institute (1 & 2)
State University of New York (1)
University of Arizona (1)
University of Texas, Austin (1)

Cognitive Science: General

FRANCE
Ecole Polytechnique (1)
GERMANY, WEST
Max Planck Institute of Behavioral Physiology (2)
Max Planck Institute for Biological Cybernetics (2)
Max Planck Institute for Biophysical Chemistry (2)
UK
Brunel University (1)
USA
Carnegie-Mellon University (1)
Institute for Cognitive Science: Univ. of California, San Diego (2)
Institute of General Semantics (2)
Salk Institute (2)
State University of New York (1)

Complex Dynamical Systems: General

BELGIUM
Free University of Brussels (1)
WEST GERMANY
University of Stuttgart (1)
USA
Center for Complex Systems Research:Univ. of Illinois (2)
Center for Large-Scale Systems: Purdue Univ. (2)
Center for Nonlinear Studies: Los Alamos Nat. Lab. (2)
Center for the Study of Complex Systems:Univ. of Arizona (2)
Complex Systems Research Center: Univ. of New Hampshire (2)
Control Science and Dynamical Systems Center:Univ. of Minnestoa (2)
Systems Dynamics Group: MIT (2)
Systems Theory Program: National Science Foundation (2)
Santa Fe Institute (1 & 2)
State University of New York (1)
University of Arizona (1)
University of Texas, Austin (1)

Complex Dynamical Systems: Mathematical Sciences

CANADA
Centre de Recherches Mathematiques: Univ. of Montreal, (2)
GERMANY, EAST
Academy of Sciences of the GDR (1)
USSR
Scientific Research Institute for Applied Mathematics and Cybernetics (2)
USA
Center for Adaptive Systems: Boston Univ. (2)
Center for Nonlinear Studies: Los Alamos Nat. Lab. (2)
Courant Institute of Mathematical Sciences: New York Univ. (2)

Institute for Advanced Study: Princeton, (2)
Lefschetz Center for Dynamical Systems:Brown Univ. (2)
Santa Fe Institute (1 & 2)
Washington University (1)

Complex Dynamical Systems: Physical Sciences

CANADA
Theoretical Physics Group: Univ. of Calgary (2)
BELGIUM
Free University of Brussels (1)
GERMANY, WEST
Max Planck Institute for Biophysical Chemistry (2)
University of Stuttgart (1)
USA
Center for Nonlinear Dynamics: Univ. of Texas (2)
Center for Nonlinear Studies: Los Alamos Nat. Lab. (2)
Ilya Prigogine Center for Studies in Statistical Mechanics: Univ. of Texas, (2)
Institute for Advanced Study: Princeton, (2)
National Center for Atmospheric Research (2)
Santa Fe Institute (1 & 2)
State University of New York (1)
Systems Dynamics Group: MIT
University of Arizona (1)
University of Texas, Austin (1)

Computer Science: General

GERMANY, EAST
Academy of Sciences of the GDR (1)
UK
Brunel University (1)
North East London Polytechnic (1)
USA
Carnegie-Mellon University (1)
Case Western Reserve University (1)
Fairleigh Dickinson University (1)
Louisiana State University (1)
Providence College (1)
State University of New York (1)
Systems Research Center:Univ. of Maryland (2)
University of Massachusetts (1)
University of Michigan (1)
University of North Carolina, Chapel Hill (1)
University of Pittsburgh (1)

Cybernetics

AUSTRIA
University of Vienna (1)
CANADA
Concordia University (1)
York University (1)
GERMANY, EAST
Academy of the Sciences of the GDR (1)
USSR
Council on Cybernetics, Armenian SSR Academy of Sciences (2)
Institute of Cybernetics, Azerbaijan SSR Academy of Sciences (2)
Institute of Cybernetics, Estonian SSR Academy of Sciences (2)
Institute of Cybernetics, Ukranian SSR Academy of Sciences (2)
Institute of Engineering Cybernetics:Byelorussian SSR (2)
Kiev T. G. Shevchenko State University (1)
Scientific Research Institute for Applied Mathematics and Cybernetics (2)
Tibilisi State University (1)
UK
Brunel University (1)
Institute for Cybernetics:King's College:United Kingdom (2)
USA
Center for Cybernetic Communications Research: Colorado State Univ (2)
Center for Cybernetic Studies: Univ. of Texas (2)
Center for Cybernetic Studies in Complex Systems: Old Dominion Univ., (2)
Louisiana State University (1)
Old Dominion University (1)
Portland State University (1)
San Jose State University (1)
State University of New York, Systems Science (1)
Texas Tech University (1)
University of California, Los Angeles (1)
University of Pennsylvania, Social Systems Science (1)
Washington University (1)

Design: Urban and Environmental Planning

UK
Architectural Association School of Architecture (1)
USA
Antioch University, Seattle (1)
University of Louisville, Belknap Campus (1)
University of Michigan (1)

Economic Systems: General

CANADA
York University (1)
DENMARK
Copenhagen School of Economics (1)
USA
Stanford University (1)
Systems Dynamics Group: MIT (2)

Education and Educational Technology

CANADA
Concordia University (1)
UK
Brunel University (1)
USA
International Systems Institute:Far West Laboratory (2)
Saint Lawrence University (1)
Scientific Reasoning Research Institute:Univ. of Mass. (2)
Systems Dynamics Group:MIT (2)
University of Minnesota (1)

Engineering and Design: Engineering-Economics

USA
Stanford University (1)

Engineering and Design: Systems Engineering

CANADA
University of Ottawa (1)
FINLAND
Helsinki University of Technology (1)
MEXICO
Monterrey Institute of Technology (1)
National Polytechnic Institute (1)
UK
Brunel University (1)
Portsmouth Polytechnic (1)
USA
Boston University (1)
Case Western Reserve University (1)
Center for Research in Engineering and Advanced Technology:State Univ. of NY (2)
Center for Systems Science: Yale Univ., (2)
Fairleigh Dickinson University (1)
Georgia Institute of Technology (1)
Michigan State University (1)
North Carolina State University (1)
Oakland University (1)
Ohio University (1)
Old Dominion University (1)
Providence College (1)
Stanford University (1)
Systems Dynamics Group: MIT (2)
Systems Research Center: Univ. of Maryland (2)
Systems Theory Program: National Science Foundation (2)
University of Arizona (1)
University of California, San Diego (1)
University of Florida (1)
University of Michigan (1)
University of Pennsylvania (1)
University of Texas, Austin (1)
University of Toledo (1)
Washington University (1)

Health Sciences: Family Therapy and Psychiatry

BELGIUM
Institute for Family and Human Systems Studies (1)
CANADA
University of Calgary (1)
GERMANY, WEST
Arbeitsgruppe für systemische Therapie - AST (1)
Berliner Institut für Familientherapie, (1)
Institut für Familientherapie:Siegen (1)
Institut für Familientherapie: Frankfurt, (1)
Institut für systemische Studien e.V.: Hamburg (1)
Institut für systemisch Therapiestudien: Marburg (1)
ITALY
Centro Milanese di Terapia Cognitiva (2)
Centro Psicoterapia Cognitiva: Rome (2)
Centro Studi Famiglia: Rome (2)

USA
Ackerman Institute for Family Therapy, (1)
Texas Tech University (1)

Health Sciences: General

AUSTRIA
University of Vienna (1)
CANADA
University of British Columbia (1)
POLAND
Institute of Biocybernetics and Biomedical Engineering (2)
USA
Systems Dynamics Group:MIT (2)
Systems Science Institute:Univ. of Louisville (2)

Information Sciences: General

DENMARK
Copenhagen School of Economics (1)
GERMANY, EAST
Academy of Sciences of the GDR (1)
NORWAY
Institute for Information Systems Research (2)
University of Oslo (1)
SWEDEN
Royal Institute of Technology (1)
University of Ostersund (1)
University of Stockholm (1)
UK
University of Hull (1)
USA
Fairleigh Dickinson University (1)
University of Massachusetts (1)
University of Michigan (1)
University of North Carolina, Chapel Hill (1)
University of Pittsburgh (1)
Winston-Salem State University (1)

Management Science: Systems Management

CANADA
University of Ottawa (1)
IRAN
Industrial Management Institute (1)
UK
City University (1)
Open University (1)
University of Hull (1)
University of Lancaster (1)
USA
American University (1)
Center for Interactive Management: Geroge Mason Univ., (2)
Fielding Institute (1)
Fordham University, Lincoln Center (1)
George Washington University (1)
Marylhurst Educational Center (1)
Massachusetts Institute of Technology, (1)
Old Dominion University (1)
Portland State University (1)
Stanford University:Terman Engineering Cntr. (1)
System Dynamics Laboratory: Univ. of Southern Calif. (2)
University of Miami (1)
University of North Carolina, Chapel Hill (1)
University of Southern California (1)

Operations Research

USA
New York Polytechnic Institute (1)
Michigan State University (1)
Stanford University (1)
State University of New Jersey (1)
University of North Carolina, Chapel Hill (1)
University of Pennsylvania (1)
University of Washington (1)

Philosophy

USA
Center for Process Studies: Cal. State, Claremont (2)
Institute of General Semantics (2)
State University of New York, Philosophy (1)

Safety Engineering and Management

USA
Institute of Safety and Systems Management: Univ. of Southern Calif. (2)
University of Southern California (1)

Social Systems Science: Anthropology

USA
San Jose State University (1)

Social Systems Science: General

BELGIUM
Institute for Family and Human Systems Studies (1)
WEST GERMANY
University of Bielefeld (1)
University of Siegen (1)
IRAN
Industrial Management Institute (1)
NORWAY
University of Oslo (1)
USA
Fielding Institute (1)
San Jose State University (1)
Saybrook Institute (1)
State University of New York (1)
University of Louisville, Belknap Campus (1)
University of Minnesota (1)
University of Pennsylvania (1)

Systems Analysis

CANADA
University of Ottawa (1)
York University (1)
POLAND
Institute for Systems Research (2)
UK
City University (1)
University of Hull (1)
University of Lancaster (1)
USA
American University (1)
Case Western Reserve University (1)
Fordham University, Lincoln Center (1)
George Washington University (1)
Georgia Institute of Technology (1)
Louisiana State University (1)
New York Polytechnic Institute (1)
Stanford University (1)
Systems Theory Program: National Science Foundation (2)
University of Arizona (1)
University of California, San Diego (1)
University of Miami (1)
University of Michigan (1)
University of North Carolina, Chapel Hill (1)
University of Pennsylvania (1)
University of Washington (1)
Washington University (1)

Systems Analysis: Comparative

USA
California State Polytechnic University, Pamona (1)

Systems Science: General

AUSTRIA
Johannes Kepler University Linz (1)
International Institute for Applied Systems Analysis, IIASA (2)
University of Vienna (1)
CANADA
Center for Systems Research, Univ. of Alberta (2)
University of Ottawa (1)
York University (1)
DENMARK
Copenhagen School of Economics (1)
FRANCE
College de Systemique de l'AFCET (1)
JAPAN
Shizuoka Kenritsu (Perfecture) University (1)
NETHERLANDS
Afdeling Bedryskunde (1)
Erasmus University Rotterdam (1)
NORWAY
University of Oslo (1)
SINGAPORE
Institute of Systems Science (2)
SWEDEN
Royal Institute of Technology (1)
University of Karlstad (1)
University of Ostersund (1)
University of Stockholm (1)
USSR
Kiev T. G. Shevchenko State University, (1)
Tibilisi State University (1)
UK
Brunel University (1)
USA
Antioch University, Seattle (1)
California State Polytechnic University, Pamona (1)
Center for Large-Scale Systems:Purdue Univ. (2)
Fairleigh Dickinson University (1)
Louisiana State University (1)
Portland State University (1)
San Jose State University (1)
Santa Fe Institute (1)
State University of New York (1)
University of California, Los Angeles, (1)

1. Programs of Study: Degree-Granting Institutions

DESCRIPTION: listed here are institutions where degree-granting programs in the sciences of complexity are offered. These programs of study provide graduate and/or undergraduate instruction leading to Bachelor of Science or Arts, Master of Science or Arts, and Doctor of Philosophy degrees.

The entries are at various stages of completion; entries with annotations were those first encountered and thus information on them was sought first. Entries without annotations will have them in the future as time and money allow further work on the guide. Entries marked by an asterisk (*) are still under verification. These programs are arranged alphabetically first by country and second by the institution where they're offered. To locate these programs and degrees by subject, refer to the Subject Locater Index.

AUSTRIA

Johannes Kepler University Linz:
Department of Systems Science
Altenbergenstrasse 69
A-4045 Linz-Auhof, AUSTRIA
Franz Pichler
Phone: (0732) 23-13-81; 23-23-81

University of Vienna:
Department of Medical Cybernetics and Artifical Intelligence
Freyungstrasse 2
A-1010 Vienna, AUSTRIA
Robert Trappl

BELGIUM

***Free University of Brussels:**
Université Libre de Bruxelles
Ave. Franklin D. Roosevelt, 50
1050 Bruxelles
Phone: (02) 642-2111

Institute for Family and Human Systems Studies:
Rue Van Eyck 11c
B-1050 Brussels, BELGIUM
Phone: 02/6477343

CANADA

Concordia University:
Educational Technology Department
1455 de Maisonneuve Boulevard West — Gary Boyd, faculty
Montreal, QUEBEC H3G 1M8 — (514) 848-2424

Degree(s): Master of Arts and Doctor of Philosophy in Educational Technology. "Educational Technology is a broad, interdisciplinary field concerned with the application of scientific knowledge to produce desirable educational outcomes. It involves the incorporation of a variety of media into the educational setting as well as the application of behavioral science principles to solve human learning problems. It

applies the concepts of general systems theory and cybernetics as an integrated problem solving approach to educational problems."

"The Doctor of Philosophy degree is designed to provide opportunities for advanced study both in the theoretical foundations of educational technology and in the application of such knowledge in organizations devoted to education and training..." "A Ph.D. student selects from two areas of specialization from among those offered in the Graduate Programme in Educational Technology." The structure of the student's programme is based either on an emphasis upon applied professional skills (e.g. design of self-instructional systems, evaluation, human resources development) or upon interdisciplinary approaches to his/her research area (e.g. educational cybernetics, statistical methods, theory and methodology of educational systems research).

University of British Columbia:
Division of Health Systems
#400 - 2194 Health Sciences Mall
Vancouver, B.C. V6T 1Z6, CANADA
John H. Milsum

University of Calgary:
Faculty of Medicine
Department of Psychiatry; Family Therapy Program
The University of Calgary Medical Clinic
3350 Hospital Drive NW — Karl Tomm, Director
Calgary, ALBERTA, Canada T2N 4N1 — Phone: (403) 220-3300

Degree(s): Master of Science in Family Therapy. Systems education at the University of Calgary is found in the Family Therapy Program "…established in the Dept. of Psychiatry, Faculty of Medicine in 1973. It is a clinical outpatient treatment program which provides specialized services in family and marital therapy. The program provides ongoing teaching. Over the past 15 years, family therapy training has been provided for psychiatrists, nurses, psychologists, psychiatric residents, family practice residents, educational psychologists, social workers and educators. "The orientation for the program, in terms of the framework of clinical understanding and pattern of therapeutic practice, has continually evolved"—integrating the McMaster problem solving approach; structural theory, communication theory, cybernetics in the mid-70's; Milan approach based on Bateson's philosophy of mind in the late 70's; and Maturana's theory of cognition in the early 80's; and then in 1986 incorporating Michael White's (Australia) clinical methods. "Thus, the Calgary program has been very actively involved in a continuous process of examining, exploring, developing, and applying new patterns of therapeutic thought and action."

University of Ottawa:
Faculty of Administration
Systems Science Programme — Jérome Doutriaux, Prgm. Chairman
Ottawa, Ontario, K1N 9B5 — Phone: (613) 231-7004

Degree(s): Master of Science in Systems Science. "The Master of Science in Systems Science is specially designed for those who are interested in the analysis and mathematical or computer modelling of natural and man-made systems. It provides the professional with the skills and knowledge required to understand, control, predict, and optimize behavior in a variety of fields from engineering and computer science to management and applied economics. An interdisciplinary programme of the School of Graduate Studies and Research, it is supervised by a Co-ordinating Committee composed of representatives from the Departments of Computer Science, Electrical Engineering, Mathematics, Economics, and the Faculty of Administration.

"The degree may be completed with thesis or without thesis. The emphasis is on flexibility, each student being able to plan, with the help of his academic advisor, a programme best adapted to his background, areas of interest and expertise. Courses

in simulation and modelling, control theory, applied probability, mathematical economics and optimization comprise the core of the program, with optional courses available from the five participating departments in a variety of topics in the foundations, methodology and applications of Systems Science."

York University:
Department of Economics
Systems Analysis and Cybernetics Program
Toronto, Ontario, M3J 2R2

DENMARK

***Copenhagen School of Economics:**
Institute for Datology and Systems Science
Julius Thomsens Plads 10
DK-1925 Copenhagen C; DENMARK
Peter Pruzan, chairman

FINLAND

***Helsinki University of Technology:**
(Teknillinen Korkeakoulu)
Otakaar 1
02150 Espoo 15
Phone: (358)-0-460-144

***University of Helsinki:**
Department of Education
Fabianinkatu 28A
SF-00100 Helsinki 10
Singa Sandelin

FRANCE

Ecole Polytechnique:
Centre de Recherche Epistemologie et Autonomie
Crea 1 Rue Descartes
Paris, 75005 FRANCE
Jean-Pierre Dupuy

GERMANY, EAST

Academy of Sciences of the GDR:
Department of Mathematics/Cybernetics
Rudower Chaussee 5
1199 Berlin-Alderhof, E. Germany
Manfred Peschel

Academy of Sciences of the GDR:
Central Institute for Cybernetics and Information Processing
Leipziger Strasse, 3-4
1086 Berlin, E. Germany

GERMANY, WEST

***Arbeitsgruppe für systemische Therapie - AST:**
c/o Friedrich-Balck
Klaus-Groth-Str. 8; FR GERMANY
2400 Lübeck 1

***Berliner Institut für Familientherapie:**
Stallupöer Allee 29
1000 Berlin 19; FR GERMANY
tel. (030) 305-1082

***Institut für Familientherapie:**
Siegstrasse 24
5900 Siegen; FR GERMANY
tel. 0271/44000

***Institut für Familientherapie:**
Zeisselstrasse 11
6000 Frankfurt; FR GERMANY
tel. 069/551880

***Institut für systemische Studien e.V.:**
Schäferstrasse 33
2000 Hamburg 6; FR GERMANY
tel. 04346/8139

***Institut für systemisch Therapiestudien:**
Friedrich-Naumann-Str. 9
3350 Marburg; FR GERMANY
tel. 06421/14330

***University of Bielefeld:**
Department of Sociology
Bielefeld, FR GERMANY
Niklas Luhmann, Dirk Becker

***University of Hamburg:**
Edmund-Siemens-Allee 1
2000 Hamburg 13
Phone: (040) 4123-4475

***University of Siegen:**
Cultural and Communications Studies, Graduate College
Siegen, FR GERMANY
Hans Ulrich Gumbrecht

***University of Stuttgart:**
Institut für Theoretische Physik
Pfaffenwaldring 57/IV — Hermann Haken, Inst. Director
D-7000 Stuttgart 80 — Phone: (0711) 20731

The Institute for Theoretical Physics at the University of Stuttgart is one of the leaders in the study of *synergetics*, a science that is concerned with the study of systems that produce macroscopic spatial, temporal, or functional structures. Synergetics studies many forms of self-organization in nonequilibrium systems and has contributed greatly to the understanding of order and organization in the natural world.

IRAN

***Industrial Management Institute:**
Social Systems Science Program
Jam-eJam Avenue; Pahlavi Road
Tehran, IRAN
Jamshid Gharajedaghi

JAPAN

Shizuoka Kenritsu (Perfecture) University:
Systems Science Program
3-41-21 Ogikubo
Syginami-ku
Tokyo 167
Dr. Yoshihide Horiuchi

MEXICO

***Monterrey Institute of Technology:**
Instituto Technológico y de Estudios Superiores de Monterrey
Avenida Eugenio Garza Sada 2501
Sucursal de Correos, 'J'
64849 Monterrey, Nuevo León
Phone: (83) 58-20-00

***National Polytechnic Institute:**
Instituto Politécnico Nacional
Avenida Juan de Dios Bátiz s/n
esq. Luis Enrique Erro
Zacateco, 07738, México, D.F.
Phone: 754-41-02

NETHERLANDS

Afdeling Bedryskunde:
Department of Systems Science
Postbus 513
Eindhoven

***Erasmus University Rotterdam:**
Burgemeester Oudlaan 50
Postbus 1738
3000 DR Rotterdam
Phone: (010) 408-111

***Interuniversitaire Interfacultet:**

NORWAY

University of Oslo:
Social Informatics Program
Box 1096
Blindern N-3 Oslo
Stein Braten

SWEDEN

***Lund University:**
P.O. Box 117
221-00 Lund
Phone: 46(46)-107000

Royal Institute of Technology:
(Kungliga Tekniska Högskolan)
Informatics and Systems Science Program
S-100 44 Stockholm
Phone: 468-79 06000
Kjell Samuelson

University of Karlstad:
Department of Systems Science
Box 9501
S-650 Karlstad 09
Phone: (054) 13-00-20
Jan O. Aberg

University of Ostersund:
Informatics and Systems Science Program
Box 373
Ostersund S-83125
Stig Holmberg

University of Stockholm:
Informatics and Systems Science Program
106 91 Stockholm
Phone: (08) 16-20-00
Kjell Samuelson

UNION OF SOVIET SOCIALIST REPUBLICS

Kiev T. G. Shevchenko State University:
Faculty of Cybernetics
ul. Vladimirskaya 64
252017 Kiev
Ukranian SSR, USSR

Tibilisi State University:
Faculty of Cybernetics and Applied Mathematics
Pr. Chavchavadze 1
380028 Tibilisi
Georgian SSR, USSR
R. Kordzadze

UNITED KINGDOM

***Architectural Association School of Architecture:**
Graduate School
34-6 Bedfore SQ, London WC1, UK
Royson Landau, director

Brunel University:
Faculty of Technology
Department of Electrical Engineering & Electronics
Division of Cybernetics — I. Aleksander, Dept. Head
Oxbridge, Middlesex, UB8 3PH England — Phone: (0895) 74000

Degree(s): Master of Science and Doctor of Philosophy. "The Division of Cybernetics encourages research in all aspects of cybernetics and closely related sciences. In pursuit of the latter goal, peripheral research projects have been set up involving not only other departments at Brunel but also organisations outside the University. At present most of the work of the Division is concentrated in the following fields: 1) Artificial Intelligence: this includes the techniques of heuristic programming to provide 'purpose-built' entities, especially in the fields of planning, problem-solving and decision-making where there is an emphasis on cognitive approach; 2) Educational Cybernetics: there is a particular interest in computer assisted learning especially where it involves the cybernetic nature of the student/teacher interaction; 3) Behavioral Cybernetics: there is a special interest in all aspects of cognition with particular emphasis placed on the development of models of cognitive processes. In the connection computer simulation of human behavior is frequently used as a research tool; 4) Human-Computer Systems: the changes in the technological texture of our culture have created a demand for thinking about the Human-Computer relationship in a fresh way. The central tenet of the Division's approach is that Human-Computer systems need to be conceived, designed, and evaluated in terms of a *conversational* system. This approach is necessary in order to apply and further develop the techniques and theories in cognitive psychology, artificial intelligence and the theory of knowledge to the design of Human-Computer Systems."

City University:
Department of Systems Science
Northhampton Square — E. R. Carson, Robert Flood, faculty
London, EC1V OHB, England — Phone: (01) 253-4399

Degree(s): Bachelor of Science in Management and Systems. "The honours BSc course in Management and Systems is designed to give a sound education to the student who intends to enter a career in modern management. It offers an extended treatment of the analysis of systems, planning, management and decision-making which will enable future managers to deal with the very complex problems that arise from the interactions between the technological, economic, social and political forces that exist in the modern world. Systems Science provides 1) the structured approach to the study and resolution of very complex organizational problems, and 2) the coordinating framework for bringing the related disciplines to bear on a particular problem.

***North East London Polytechnic:**
Department of Systems and Computing
Dagenham, Essex RM8 2AS England
J. R. Thompson

Open University:
Faculty of Technology
Systems Group
Walton Hall — William Mayon-White, faculty
Milton Keynes MK7 6AA, England — Phone: (0908) 74066

Degree(s): Bachelor of Science, Master of Science in Systems Management. The Open University provides studies of the systems approach through the teaching of various management skills: business, education, and industry.

***Portsmouth Polytechnic:**
Architecture
Portsmouth, UK
Ranulph Glanville

University of Hull:
Department of Management Systems and Sciences — Mike Jackson, faculty
Hull, HU6 7RX, England — Phone: (0482) 46311

Degree(s): Bachelor of Arts, Master of Arts in Management Systems; Bachelor of Science, Master of Science in Management Sciences; Postgraduate Diploma; MSc, MPhil & PhD by Research. "The Department of Management Systems and Sciences is a multidisciplinary group with interests spanning Management Theory, Operational Research, Systems Theory, Organisational Analysis and Development, and Computer Applications including the development of knowledge-based Decision Support Systems. "The MA programme is especially suitable for graduates in Business or Management Studies, the Social Sciences or Modern Languages. "The MSc programme is designed primarily for applicants whose undergraduate training included an Operational Research/Management Science component. "The Department welcomes enquiries from graduates interested in undertaking research in a field appropriate to the Department's interests. Recent research has included the development of microcomputer-based information and decision-support systems, the study of managerial problem solving based on systems methodologies..."

University of Lancaster:
Department of Systems
School of Management and Organizational Sciences
Bailrigg — Peter Checkland, faculty
Lancaster, LA1 47X, England — Phone: (0524) 65201

Degree(s): Master of Arts in Systems Management, Master of Philosophy, Doctor of Philosophy. "The Department of Systems is concerned with developing systems approaches to a wide range of real world problems and situations. The department runs a twelve month course for the degree of M.A. in Systems in Management and provides facilities for research work leading to the degrees of M.Phil. and Ph.D. Many Master's degree and Ph.D. students take part in a major project in industry or in some other organization during their stay at Lancaster. There is also a widely based research and applications programme conducted by the staff of the department, a great deal of which is carried out in collaboration with outside organizations. The success of the project and consultancy work of the department has led to the formation of an associated company, I.S.C.O.L.(International Systems Corporation of Lancaster) Ltd., which now administer all this work and which is better able to provide facilities for its expansion. In 1969 the department also launched the *Journal of Applied Systems Analysis* which aims to describe applications to the systems approach to a wide variety of problems in industry, commerce and government.

UNITED STATES

Ackerman Institute for Family Therapy:
149 East 78th Street
New York, NY 10021 USA Donald A. Bloch, M.D., director

Family Therapy, more than any other clinical domain, has learned from cybernetics, systems theory and holistic thinking. The Ackerman Institute for Family Therapy, founded in 1960, serves a variety of functions in the field of family therapy. "The Institute serves the educational needs of many professionals who, in turn, serve the needs of families. "The Ackerman Institute Clinic serves as a treatment center for families with a broad spectrum of problems, including marital stress, depression, school failure, and various neuroses, psychoses, and psychosomatic disorders. Therapy is provided by psychiatrists, psychologists, and psychiatric social workers on the faculty, and mental health professionals presently in postgraduate training and supervision at the Institute." The Institute also engages in research activities.

***American University:**
Center for Technology and Administration
Washington, D.C. 20016
Robert Johnson

Antioch University, Seattle:
Whole Systems Design Program
2607 Second Avenue Harold Nelson, director
Seattle, WA 98121 Phone: (206) 441-5352

Degree(s): Master of Arts in Whole Systems Design. "The graduate program in Whole Systems Design is for people who wish to enrich their present skills and training with a systems perspective, design abilities and holistic attitudes. "The program is a synthesis of rational, creative and holistic thinking…" combining three elements, 1) The Systems Approach that enables us to recognize, conceptualize and describe the complexity found in natural and human systems, 2) Design, which is inclusive of a wide spectrum of creative activities, and 3) Holism, a perspective that focuses on the qualities and attributes of a system which emerge from the patterning of complex systems but that are not part of the individual elements that make up the system. "Each student participates in a degree process which facilitates learning through a synthesis of individualized student interests and program requirements."

Boston University:
Systems Engineering Program
Boston, MA 02215

California State Polytechnic University, Pamona:
Department of Biological Sciences
Institute for Advanced Systems Studies
3801 West Temple Avenue Lenard R. Troncale, Inst. coordinator
Pamona, CA 91768 Phone: (714) 869-4040

Degree(s): Bachelor of Science Minor in Comparative Systems Analysis. "The Institute for Advanced Systems Studies at Pamona College offers courses leading to a minor in comparative systems analysis. The minor complements a wide variety of major fields from the various schools of the university. Students completing this minor will have developed skills in analyzing complex environmental and other systems problems. Course work in this minor emphasizes the application of transdisciplinary techniques and methodology, and exposes the student to faculty from a broad spectrum of specialties, unified by general systems analytic approaches. The comparative systems analysis minor requires a minimum of approaches. The comparative systems analysis minor requires a minimum of 32 units."

***Carnegie-Mellon University:**
Department of Computer Science
Pittsburgh, PA 15213
Geoffery E. Hinton

***Carnegie-Mellon University:**
Department of Psychology
Pittsburgh, PA 15213
James L. McClelland, Alan H. Kawamoto

***Case Western Reserve University:**
Systems Engineering, Computer Engineering and
Information Sciences
Cleveland, OH 44106
Stephen Kahne

***Dartmouth College:**
Graduate Program in Systems Simulation
and Policy Design
Hannover, NH 03755
Dennis Meadows

Fairleigh Dickinson University:
Teaneck-Hackensack and Rutherford Campuses
College of Science and Engineering, Systems Science Major
Rutherford, NJ 07070 Phone: (201) 460-5267

Degree(s): Master of Science in Systems Science. "The Master of Science with a major in systems science degree program is an interdisciplinary curriculum designed to provide practicing scientists and engineers with advanced knowledge of contemporary topics of interest in information management and movement. The 36-credit program of study is primarily technical, consisting of an integrated program sequence of advanced-level courses in computer science, electrical engineering, and mathematics. However, management/finance courses may be included which will provide the student with a background in economic-based issues which inevitably accompany technical problems."

Fielding Institute:
Human Organizational Systems Program
2112 Santa Barbara, CA 93105
Donald Bushnell

Fordham University, Lincoln Center:
Graduate School of Business Administration
113 West 60th Street Milan Zeleny, faculty
New York, NY 10023 Phone: (212) 579-2000

Degree(s): Master of Business Administration in Systems Management. Systems education at Fordham University is found within the MBA degree's Management Systems option. "The management systems curriculum prepares managers to lead the organizational change necessary for businesses to survive in today's competitive world. It offers a unique blend of courses that go beyond the narrow functional specializations of the past era, integrating behavioral and quantitative methods of modern management. "The program presents Integrated Process Management (IPM)—a new management technology with remarkable potential for improving quality, productivity, and long-term competitive position." The new perspectives of dynamical system theory, self organization, self management, autopoiesis, and theories of chaos form an integral part of the curriculum. Within the management systems curriculum the

student has a possibility of two concentrations: management of human systems and design of human systems."

George Washington University:
School of Government and Business Administration
General Management Systems Program
Monroe Hall 203A — Stuart Umpleby, GEMS faculty
Washington, DC 20052 — Phone: (202) 944-1000

Degree(s): Master of Business Administration and Doctor of Philosophy in Management Science. "The program of study leading to the MBA provides a basic foundation in the functions of business, the environment in which it operates, and the analytical tools needed for intelligent decision making. The program provides a study in depth in one field of instruction and a broad exposure to subjects and issues at the general management level." Several "fields of instruction" within GWU's MBA program incorporate systems education, especially the General Management Systems field, but also Information Systems Management, Decision Systems, and the Organizational Behavior and Development fields.

General Management Systems "addresses the critical need for management to deal effectively with the fact that human institutions of all kinds tend to become larger and more complex as changes accelerate both socially and technologically. In many traditional academic fields, general systems theory and cybernetic concepts have evolved as the interdisciplinary mode for understanding increasingly complex systems. "Because this program is essentially interdisciplinary and transcontextual in nature, the student is afforded an unusually broad range of opportunities to apply educational experience to managerial, organizational, and societal problems. Professional and academic career potentials are available in the following fields: 1) research and teaching in the growing number of systems and cybernetics oriented programs now emerging in colleges and universities in the US and elsewhere in the world; 2) institutional/environmental interface management or consulting; 3) system-focused organizational development consulting or staff work; 4) corporate and government agency long-range (strategic) planning and control activities; 5) advisory and staff positions and program directors in global agencies such as operating components of the United Nations, multinational corporations and foundations, and multigovernmental agencies such as OECD, as well as agencies and departments of national governments."

Georgia Institute of Technology:
Industrial Systems Engineering
Atlanta, GA 30332

Louisiana State University:
Department of Computer Science
Interdepartmental Program in Systems Science
298 Coates Hall — Donald H. Kraft, Program Coordinator
Baton Rouge, LA 70803 — Phone: (504) 388-1495

Degree(s): Master of Science in Systems Science. "The Department of Computer Science administers an interdisciplinary program leading to the degree of M.S. in Systems Science. Graduate faculty members in areas of business, engineering, mathematics, library science, statistics, and computer science participate in this program. In addition, students and faculty from Southern University, Baton Rouge, and the University of Southwestern Louisiana, Lafayette, may participate in the program.

"Admission requirements include a baccalaureate degree in a systems-related area from an accredited college or university. Undergraduate preparation must include at least nine semester hours of differential and integral calculus and should include course work in computing, statistics, and operations research.

"Students may select a thesis or system design project option. Course work requirements include study in such core areas as computer science, operations research, cybernetics, data structures and management, system simulation and numerical analysis, statistics, and systems theory. The curriculum provides for specialization in any area related to systems science. The Department of Quantitative Business Analysis and the School of Library and Information Science are particularly strong participants in the program."

Marylhurst Educational Center:
Systems Management Program
Marylhurst, OR 97039
Michael Benton

Massachusetts Institute of Technology:
Sloan School of Management
Systems Dynamics Program
Cambridge, MA 02139
Jay Forrester, John D. Sterman

Michigan State University:
College of Engineering
Dept. of Electrical Engineering and Systems Science Harriett B. Rigas, chair
East Lansing, MI 48824 Phone: (517) 355-8332

Degree(s): Bachelor of Science, Master of Science, and Doctor of Philosophy in Systems Science. "Underlying the complexities of modern civilization and technology are similarities which make it possible to approach problems in many diverse fields with essentially the same concepts, theories, and techniques. The undergraduate program in systems science integrates studies in mathematics, statistics, computer science and other areas with the basic concepts in systems science.

"The Department of Electrical Engineering and Systems Science also offers an interdepartmental Master of Science degree program in systems science-urban studies. The Department cooperates with the Department of Management and the Department of Statistics and Probability in offering a program in operations research-systems science leading to the M.S. degree."

New York Polytechnic Institute:
Department of Operations Research and Systems Analysis
333 Jay Street
Brooklyn, NY 11201

North Carolina State University:
Department of Systems Engineering
P.O. Box 5511
Raleigh, NC 27607

Oakland University:
School of Engineering
Systems Engineering Program
Rochester, MI 48309-4401

***Ohio University:**
Department of Industrial and Systems Engineering
Athens, OH 45701
Robert Williams

Old Dominion University:
Department of Engineering Management
1108 Brandon Road — Fred Steier, Larry Richards, faculty
Norfolk VA 23529 — Phone: (804) 683-3000

Degree(s): Master of Engineering Management and Doctor of Philosophy. "Building on concepts in systems science and systems engineering, the Master of Engineering Management program bridges the gap between the many educational programs oriented toward executive management and the needs of engineering and science professionals. The program is oriented toward the design and management of technical projects, complex operations, and technology-based organizations. With the participation of the College of Business and Public Administration and the Department of Mathematics, the curriculum is multidisciplinary."

"The Doctor of Philosophy program prepares students for careers in teaching and research at universities and other institutions of higher education, as well as in other private and public organizations. It also supports administrative careers in research, development, and design activities involving high technology. The engineering management major is a multidisciplinary program of studies oriented to the design and management of complex human-technological systems. Students select one or more of five interrelated concentration areas: sociotechnical systems; human performance engineering; knowledge systems; technology, policy, and society; and systems theory and cybernetics."

Portland State University:
Systems Science Ph.D. Program
P.O. Box 751 — Martin Zwick, program director
Portland, OR 97207 — Phone: (503) 229-4960

Degree(s): Doctor of Philosophy in Systems Science. "The Systems Science Ph.D. program at Portland State University was established in 1970. The program encompasses both application and theory-oriented aspects of the systems fields. It is designed to prepare students for professional practice in industrial, governmental, and public service organizations, and for research and teaching in academic institutions. The School of Business Administration, the College of Liberal Arts and Sciences, and the School of Engineering and Applied Science participate in the program. In addition to the systems courses offered by these departments (e.g., cost-benefit analysis, operations research, systems analysis and synthesis, mathematical modeling, etc.) the Systems Science core faculty offer courses in information systems, risk analysis, multiple perspectives for decision making, general systems and cybernetics, and other areas.

Providence College:
Department of Engineering-Physics-Systems
River Avenue
Providence, RI 02918 — Phone: (4010 865-2140

Degree(s): Bachelor of Science in Systems Science. "The Department of Engineering-Physics-Systems offers undergraduate programs designed to prepare individuals for careers in applied science and engineering. Applied physics and multidisciplinary courses of study leading to the Bachelor of Science are available in 1) instrumentation and computation, and 2) systems science. The department hosts a combined-plan engineering program which enjoys affiliations with Columbia University and Washington University.

"The systems science program builds problem solving, planning, and technical management competencies while preparing students for a variety of career and/or graduate study options. The instrumentation and computation program provides intensive study in laboratory practice, experimental design, instrument hardware, and software engineering. The computer is studied as an instrument itself and as an integral component in complex instrument systems. Each of these programs is

founded on a humanities and technical core curriculum similar to the combined-plan engineering program."

San Jose State University:
School of Social Sciences
Department of Anthropology and Cybernetic Systems
One Washington Square — William Reckmeyer, director
San Jose, CA 95195 — Phone: (408) 924-5710

Degree(s): Master of Science degree in Cybernetic Systems. "This program is intended to provide students of all disciplines and work experience a systemic approach to the management of complexity in a technological society; the language to analyze and communicate the structure and processes of social, economic, political, behavioral, biological, and physical systems; the skills, methods, and tools to develop optimal social solutions that do not exploit one part of an organization or community for the good of another part; insights into the process and problems of important systems of the past, present and future, including the impacts of technologies on human systems and the environment."

Santa Fe Institute:
Center for the Study of Complex Systems — L. Michael Simmons, Vice President;
1120 Canyon Road — Academic Affairs
Santa Fe, NM 87501 — Phone: (505) 984-8800

Degrees: Offers summer school programs and workshops on a wide range of topics dealing with complex systems; does not grant degrees at present.

The Santa Fe Institute (SFI) is a private, independent organization dedicated to scientific research, and graduate and post-graduate education in the study of complex systems and their behavior. The initial research programs of the Institute provides a interdisciplinary focus to some of the major concerns and problems of our time, including the world economy, international stability, ecosystem dynamics, and theoretical immunology related to AIDS and the human genome. Support for SFI has come from a select group of government agencies, foundations, corporations, and individuals.

The study of complex systems requires investigators from a wide spectrum of disciplines, including the physical, mathematical, and biological sciences, the social sciences and humanities, and the behavioral and cognitive sciences, who can work together in mutually supportive research networks. SFI founders proposed a different type of institution, one free from the rigid departmental structures and narrow specializations that characterize the traditional universities. The goal is to examine the most complex problems of our world in ways that establishes partnerships among those in industry, the academic world, and public life.

SFI has created several interdisciplinary research networks that are functioning and will form the core of the expanding Institute agenda in the years immediately ahead. The members of these networks are giving impetus to the establishment of residential research programs at the Institute and a series of summer schools for advanced graduate students. The courses will gradually evolve into a comprehensive program of graduate education that will provide a training model for the scientists of the future.

***Saint Lawrence University:**
School of Education
Canton, NY 13617
Hugh Gunnison, coordinator
Program in Counseling and Human Development.

Saybrook Institute:
1772 Vallejo Street — Bela Banathy, Systems Faculty
San Francisco, CA 94123 — Phone: (415) 441-5034

Degree(s): Master of Arts and Doctor of Philosophy in Psychology or Human Science. "The Saybrook Institute is a graduate school and research center designed specifically for adult learners interested in an opportunity to produce innovative work which challenges mainstream assumptions about the study of human beings and social systems. The master and doctoral programs in Psychology and Human Science are characterized by: 1) faculty and student discovery of knowledge about human beings, 2) innovative teaching, and 3) the development of new methods of inquiry. The Saybrook curriculum does not emphasize technical skills. Instead, it seeks to strengthen critical thinking skills; to provide a working knowledge of the scientific approaches which are relevant to problems associated with human beings and which may affect professional practices, and to encourage students to develop a systemic view of the individual and the environment which they are a part.

"To meet the needs of adult learners, Saybrook uses a unique form of education called the at-a-distance learning format. Using learning guides, students complete coursework at home. Their progress is guided by faculty who communicate by phone, letter, cassette or computer. Relationships between students and faculty are established and renewed at semi-annual residential meetings.

"For the past ten years, Saybrook has been involved in the process of creating a new way to conceptualize the study of human beings which includes a search for new philosophical assumptions, methods, theories, and ways to organize a community around intellectual tasks." The new approach to academic research which Saybrook developed is known as Human Science, an approach which meets the needs for rigorous, scholarly, and empirical inquiry which deals with those aspects of human beings which make them unique.

Stanford University:
Terman Engineering Center
Department of Operations Research
Stanford, CA 94305-4022
Donald L. Iglehart

Stanford University:
School of Engineering
Department of Engineering-Economic Systems — David G. Luenberger, Dept. Chair
Stanford, CA 94305 — Phone: (415) 723-2300

Degree(s): Master of Science, Engineer, and Doctor of Philosophy in Engineering-Economic Systems. The E.E.S. Department is "dedicated to preparing individuals for careers in analyzing, managing, and creating activities of a business, financial, technical, or social nature ranging from individual projects to entire enterprises. The department emphasizes logical analysis using mathematical representations and advanced computational procedures, but complements this analysis with careful attention to framing of issues, formulation of problems and implementation of results.

"The formal coursework is organized around a set of problem solving concepts drawn from the fields of dynamics, uncertainty, optimization, economics, and decision analysis. These "portable concepts" are transferable to problems in a variety of specific areas. These concepts are presented in a set of core courses that provide a foundation for direct application and prepare students for advanced courses that explore the frontiers of research. Students benefit most from the program by acquiring first-hand experience in the capabilities of present methodology. Project courses, on-campus applied projects, and internships are available to provide this experience." Major research programs offered are: business systems, decision analysis, decision systems, economic analysis, energy modeling and analysis, information policy, mathematical systems analysis,and social analysis.

State University of New Jersey:
Rutgers Center for Operations Research
Hill Center for the Mathematical Sciences
New Brunswick, NJ 08903

State University of New York:
Philosophy Department
Watson School of Engineering
Vestal Parkway — Vito F. Sinisi, director, PACSS
Binghamton, NY 13901 — Phone: (607) 777-6509

Degree(s): Master of Arts in Philosophy and Doctor of Philosophy. "In cooperation with the Computer Science and Systems Science Departments, the Philosophy Department of SUNY-Binghamton offers an innovative, interdisciplinary program leading to the MA in Philosophy that integrates philosophy with computer science and systems science. The program prepares students for subsequent research and teaching that require knowledge of logic, philosophy of science, philosophy of language, on the one hand; and artificial intelligence, and principles of programming in conjunction with systems analysis on the other. The program anticipates and prepares the student for new directions in professional philosophy, viz., the use of programs (computer and information processing models) as an investigative tool for the analysis of traditional philosophical problems; and the use of these computer models to bring empirical consideration to bear on the evaluation of philosophical theories." The PACSS program will initiate a Ph.D. program in 1989.

State University of New York:
Watson School of Engineering
Systems Science Department
Vestal Parkway — George Klir, program director
Binghamton, NY 13901 — Phone: (607) 777-2490

Degree(s): Master of Science and Doctor of Philosophy in Systems Science. The M.S. program in Systems Science at SUNY Binghamton "provides the student with systems concepts, principles, and methods for developing an ability to understand the nature of systems problems, as well as proficiency in actual systems problem solving. Involved are problem classes such as systems modelling and simulation, systems analysis and synthesis (systems design), as well as various problems associated with the simplification of overly complex systems to make them manageable. "An emphasis in the program is given to the complementary use of philosophical, mathematical, computational, heuristic, and experimental approaches to the study of systems and systems problem solving. "The areas of focus include basic and applied general systems research, biological systems theory, modelling of physical, biological, social, and cognitive phenomena, and systems design."

SUNY also offers the degree of Doctor of Philosophy. Ph.D. studies involve research areas which are multi-disciplinary and reflect the interests of the Faculty of Systems Science as well as faculty from other schools and departments who use systems concepts and methods, computer systems, and applied mathematics in their research.

Texas Tech University:
College of Home Economics
Department of Human Development & Family Studies
Family Therapy Clinic; Box 4170 — David Todtman
Lubbock, TX 79409-4170 — Phone: (806) 742-2011

Degree(s): Doctor of Philosophy in Family Therapy. "The Marriage and Family Therapy Doctoral Program is dedicated to providing the finest creative context for the study and practice of systemic family therapies… "Family therapy philosophy, theory, training, and research at Texas Tech are principally based on the ideas and values of cybernetics, ecology, and systems theory. Although a wide diversity of clinical and

academic traditions are examined, the principle emphasis is upon evolving contextual views of therapeutic process. "Clinical training at Texas Tech provides a foundation in brief systemic orientations to therapy. Advanced clinical training and research focus on the general development and exploration of constructivist, cybernetic, and systemic therapies."

***University of Arizona:**
Systems and Industrial Engineering Department
Tuscon, AZ, 85721
Donald Schultz

University of California, Los Angeles:
College of Letters and Sciences
Bachelor of Science Program in Cybernetics
4731 Boelter Hall — Joseph J. DiStefano III, Chair
Los Angeles, CA 90024 — Phone: (213) 825-7482

Degree(s): Bachelor of Science in Cybernetics. "The interdepartmental major in cybernetics is designed primarily for highly motivated undergraduates interested in interdisciplinary activities in the life sciences, behavioral sciences, and engineering and computer sciences. Preparation for the major consists of a broad foundation in basic sciences—chemistry, biology, physics, and mathematics, plus introduction to psychology and computing. The major itself provides an introduction to modeling, information processing, control and system analysis with emphasis on quantitative ideas and methodologies. Mathematical and other analytical skills are essential in the major.

"Cybernetics majors have four options for in depth studies: life sciences, behavioral sciences, engineering and applied mathematical sciences, or an integration of courses from these areas that form a coherent cybernetics curriculum. The major is appropriate preparation for employment or for graduate studies in any of these areas, with emphasis on interdisciplinary activities. It is also appropriate preparation for professional school studies in medicine, public health, management, dentistry, and engineering."

University of California, San Diego:
Division of Engineering
Dept. of Applied Mechanics and Engineering Sciences (AMES)
4103B Engineering Building, Unit 1
Warren College — D. B. Olfe, Dept. Chair
San Diego, CA 92093 — Phone: (619) 534-4831

Degree(s): Master of Science and Doctor of Philosophy in Systems Science. "The Division of Engineering at UCSD comprises the Departments of Applied Mechanics and Engineering Sciences (AMES), Computer Science and Engineering (CSE), and Electrical and Computer Engineering (ECE). The departments offer many undergraduate curricula and graduate degree programs. "The programs and curricula of AMES emphasize education in fundamentals of engineering sciences. These principles provide a common foundation for all engineering subspecialties."

AMES offers graduate instruction leading to the M.S. and Ph.D. degrees in engineering sciences with specialization in the following areas: aerospace engineering, applied mechanics, applied ocean sciences, chemical engineering, bioengineering, engineering physics, and systems science.

University of California, San Diego:
Division of Engineering
Dept. of Applied Mechanics and Engineering Sciences (AMES)
4103B Engineering Building, Unit 1
Warren College — D. B. Olfe, Dept. Chair
San Diego, CA 92093 — Phone: (619) 534-4831

Degree(s): Bachelor of Science in Systems and Control Engineering. "AMES offers a traditional engineering program leading to the B.S. degree in engineering with options in bioengineering, chemical engineering, mechanical engineering, structural engineering, systems and control engineering, and engineering science."

The systems and control engineering option "involves mathematical modeling and analysis of complex systems in a wide variety of engineering, physical, and social problems, investigation the dynamics of these systems, and dealing with methods to control and optimize systems. The term "system" refers to a collection of objects whose characteristics and structure are to be identified for the purposes of predicting and/or controlling its future behavior. Among others, a "system" could be an interplanetary space vehicle, the national economy, a chemical process, or the human circulatory system. Generally input and output from the system are observed and used to develop or confirm dynamical mathematical models for the system. With these models, rational decision-making procedures are established and decisions are implemented to achieve prescribed system objectives. In addition to traditional mechanics courses, systems and control engineering students complete sequences in controls, optimization, communication theory, and a microprocessor controls laboratory. With this degree students are prepared to work in industry or government solving complex interdisciplinary problems."

University of Denver:
School of Systems Science
2115 So. University Boulevard
Denver, CO 80210
Hal Hendrick, dean

University of Florida:
Department of Industrial and Systems Engineering
Gainesville, FL 32611

University of Louisville, Belknap Campus:
School of Urban Planning and Development
Institute of Systems Science — John Remington, Inst. Director
Louisville, KY 40292 — Phone: (502) 588-6996

Degree(s): Master of Science in Systems Science. "The School of Urban Planning & Development offers a research based program in Systems Science directed through the Systems Science Institute (SSI). The Institute serves as a principle focus within the University of Louisville for General Systems Science activities and is recognized internationally as a center of excellence in that area. Through the SSI, the Univ. of Louisville helps to meet the need for trained persons who can conduct systems research as well as plan, design and manage complex systems. The program is oriented toward action research to address complex issues of the local urban community as well as of the state and the nation. This research places primary emphasis on health systems, information systems, and social and behavioral systems. Graduates are generalists who employ a wide variety of research designs and data analysis techniques including modelling, simulations, systems analysis, and computer implementations."

***University of Massachusetts:**
Department of Computer and Information Sciences
Amherst, MA 01003
Michael I. Jordan

***University of Miami:**
Department of Management Science
Coral Gables, FL 33124
Joseph Moder

***University of Michigan:**
School of Business Administration
Computer and Information Systems Department
Ann Arbor, MI 48109
Dennis Severance, John Holland

University of Michigan:
Ph.D Program in Urban, Technological, and Environmental Planning
218 Carver Building
506 East Liberty — Bob Marans, Director
Ann Arbor, MI 48109-2209 — Phone: (313) 764-1817
Degree(s): Doctor of Philosophy Urban, Technological, and Environmental Planning. The Urban, Technological, and Environmental Planning Ph.D. Program at the University of Michigan emphasizes a general systems perspective as part of the core course and emphasizes an overall systems approach to urban, technological, and environmental planning.

***University of Minnesota:**
Graduate Programs in Alternative Social and
Educational Futures
203-F Burton Hall
Minneapolis, MN 55455
Arthur Harkins

University of North Carolina, Chapel Hill:
Operations Research and Systems Analysis Program
Smith Building 128A
Chapel Hill, NC 27514
George E Fishman

University of Pennsylvania:
School of Engineering and Applied Science
Department of Systems; Systems M.S.E., Ph.D.
119 Towne Building — Kenneth Fegley, Dept. Chair
Philadelphia, PA 19104 — Phone: (215) 898-8241
Degree(s): Master of Science in Systems Engineering, Doctor of Philosophy: "The core issue in systems work is dealing with complexity. The programs of the Department of Systems focus on design and operation of large-scale complex systems. A common problem in large systems is that they are poorly understood and therefore inefficiently designed and operated. Thus, the systems degree programs give special attention to the methodology of problem definition to understanding the systems structure or system architecture and to effective system integration. The degree programs also develop a facility with the tools and methods necessary to deal quantitatively with large-scale systems and provide experience in using them in a specific application. "The research activities of the faculty are directed toward development of the core systems tools and methodology and toward integrated application of the tools and methodology in several interdisciplinary fields. The core

systems tools and methodology include system integration methodology, optimization and equilibrium analysis, control system analysis, simulation, scheduling, queueing, and network analysis. Application areas include structural systems, computer-integrated manufacturing systems, transportation systems, telecommunication networks, and environmental/resource systems.

"The research and courses associated with these applications areas cross disciplinary boundaries. Consequently the faculty and students in Systems typically work closely with those of other departments and schools of the university and are often associated with one of the interdisciplinary centers in the such areas as robotics, transportation, telecommunications, or artificial intelligence."

University of Pennsylvania:
School of Engineering and Applied Science
Department of Systems
Curriculum in Systems Science and Engineering
119 Towne Building — Kenneth Fegley, Dept. Chair
Philadelphia, PA 19104 — Phone: (215) 898-8241

Degree(s): Bachelor of Applied Science (B.A.S.), Bachelor of Science in Engineering (B.S.E.) with concentrations in systems science and engineering. "The complex-interactions among technical, economic, social, political, and environmental factors in any large system make it difficult to understand how to improve the design and operation of such a system. The desired objectives for large systems are frequently contradictory. Decisions must be made in the presence of uncertainty. It is toward understanding of the large-scale complex systems that the curriculum in systems science and engineering is directed."

University of Pennsylvania:
Wharton School Doctoral Programs
Social Systems Sciences M.S. & Ph.D. Program
1150 Stemberg Hall-Dietrich Hall — F. E. Emery, faculty
Philadelphia, PA 19104-6302 — Phone: (215)-898-4877

Degree(s): Master of Science and Doctor of Philosophy degrees in Social Systems Science. (Related programs within the Wharton Graduate School: Decision Sciences A.M., Ph.D.; Operations Research M.S., Ph.D.; Organization and Strategy A.M., Ph.D.) "This program, aimed at preparing students for research, administrative, and management positions in both public and private sectors, is built around the new concepts, theories, and methodologies that are increasingly referred to as *systems thinking*. The latter approaches the study of interrelated phenomena by viewing them in the form of wholes that must be conceived of and operationally understood as being indivisible. In the program this approach is applied specifically to social systems—societies, communities, public and private institutions, and organizations (such as business enterprises) that are created by people—whose essential characteristic is that they are *purposeful*.

"The study of such systems requires in-depth work in four main areas: 1) the theories and methodologies that underlie systems thinking; 2) research, planning, design, and management directed toward producing systems that can operate, learn, and adapt effectively in rapidly changing environments; 3) how to enable social systems to serve better the interests and needs of their purposeful parts—human beings—with mutual benefit; 4) how to enable systems to serve the interests of the larger systems—their environments and the societies that contain them, again with mutual benefit. "Students in the program gain practice in dealing with real problems and experience in fundamental research, planning, and design by working in small groups on projects in the Busch Center, the Wharton Applied Research Center, and other on-campus research facilities."

***University of Pittsburgh:**
Department of Information Science
Pittsburgh, PA 15260
Paul Munro

University of Southern California:
Institute of Safety and Systems Management
University Park, MC-0021 Hal W. Hendrick, Executive Director
Los Angeles, CA 90089-0021 Phone: (213) 743-6776

Degree(s): Master of Science in Systems Management. "Systems management is the joining of the fields of systems science and management to produce the necessary conceptual, human and technical knowledge required for successful management in the systems age. It provides a powerful answer to the critical questions that face complex industrial, business and defense organizations. Systems management is an effective way to solve puzzles like the information explosion and how to manage it; rapid change and new technology; shifting operational and economic environments; and the unplanned multiple effects of strategic and corporate decisions. It even provides an efficient method for coping with complexity itself. In fact, the chief virtue of a systems response to a thorny issue may well be the elegance of its approach. Modern managers at all levels who understand the principles of systems management and know how to properly use its methods have a distinct advantage. Managers who wish to perform effectively in an environment of complexity, high technology and rapid change need the adaptive skill of the systems approach.

"USC's M.S. in Systems Management provides students with an advanced level of the knowledge and skills necessary for generalists in modern management. As a plus, it also offers them flexible opportunities to choose among several different specialized fields in great demand, particularly in high-technology. Among these are: 1) Information Systems Management, 2) Human Resources Management, 3) Project Management, and 4) Systems Technology."

***University of Texas, Austin:**
Department of Electrical Engineering
P.O. Box 7728
Austin, TX 78712
Baxter Womack

***University of Toledo:**
Engineering Graduate Studies
2801 West Bancroft
Toledo, OH 43606
Roger McNichols

University of Washington:
Department of Operations and Systems Analysis
Seattle, WA 98095

Washington University:
School of Engineering and Applied Science
Department of Systems Science and Mathematics John Zaborsky, Dept. Chair
St. Louis, MO 63130 Phone: (314) 889-6000

Degree(s): Bachelor of Science, Master of Science, and Doctor of Philosophy in Systems Science. "High-technology industries and large societal systems share a vital need for competence in the engineering and mathematical techniques of systems science. "In a general sense, systems science is an approach which views an entire systems of components as an entity rather than simply an assembly of individual parts; each component is designed to fit properly with the other components rather than to function by itself. The engineering and mathematics of systems is a rapidly

developing field. It is one of the most modern segments of applied mathematics, as well as an engineering discipline. It is concerned with the identification, modeling, analysis, design, and control of systems that are potentially as large and complex as the U.S. economy or as demanding of precision and reliability as a space voyage.

"The Dept. of Systems Science and Mathematics offers undergraduate and graduate degree programs in systems science or engineering. On all levels there is an opportunity to pursue studies directed toward practical engineering careers in industry. Alternatively, the aim of the student may be scientific, to prepare toward a research career. The mobile and fast-developing state of the field and the orientation of the Department are both conducive to research oriented interests. "A very important characteristic of the systems field is that it and its practitioners must, of necessity, interact within a wide interdisciplinary environment, not only with various engineers and scientists but also with economists, biologists, or sociologists. Such interaction is both emphasized and practiced in the program.

"The Department offers two undergraduate degree programs 1) the degree B.S. in Systems Science and Engineering, which is a professional degree accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, and 2) the degree Bachelor of Science (applied science) which is a degree with a minimum of imposed structure. A combined five-year B.S.-M.S. program is also available."

Winston-Salem State University:
School of Business
Information Systems Department
1600 Wallace Street
Winston-Salem, NC 27102
Dan Radell

2. Research Centers and Institutes

DESCRIPTION: This section lists Research Centers and Institutes; operations within or associated with academic facilities that conduct theoretical and/or applied research and provide a variety of services for the institution, industry, government, or the public, such as consulting services, seminars, and project planning and development. Includes both public and private institutions.

Many of the institutions connected with these research centers offer courses and programs in nonlinear science, complex dynamical systems theory, cybernetics, self-organization, and systems theory and will be added to the guide in the future.

AUSTRIA

International Institute for Applied Systems Analysis, IIASA:
Schlossplatz 1 Thomas H. Lee, Director
A-2361 Laxenburg, AUSTRIA Phone: 2236 715210

Founded in 1972. Members are national academies of sciences or national scientific committees. Purposes are to: evaluate and solve problems caused by science and technology; develop and formulate systems analyses; promote the use of analytical techniques necessary to the study of complex problems; inform and educate those who may effectively employ the institute's findings. Serves as networking agent for international, cooperative research. Conducts research on system and decision sciences, technological development and its impact on economy and society, population, and the environment. Holds conferences and workshops; sponsors lectures; maintains the Young Scientists' Summer Program. FAX, 2236 71313; Telex, 079137 iiasa a. **Publications**: 1) IIASA-This Month (newsletter); 2) Options (journal), quarterly; 3) Annual Report; also publishes books, reports, lectures, and conference proceedings.

Institute for Medical Cybernetics:
University of Vienna
Wien, AUSTRIA
Robert Trappl, director

Institute for Theoretical Biology:
University of Vienna
Wien, AUSTRIA
Prof. Riedl, director

CANADA

Center for Systems Research, Univ. of Alberta
University of Alberta
5-21 Tory
Edmonton, ALBERTA, T6G 2H4
Richard Jung, director

Center for Systems Research, Concordia Univ.
Concordia University
Montreal H3G 1M8
P. David Mitchell

Centre de Recherches Mathematiques:
University of Montreal
C.P. 6128-A
Montreal, PQ, CANADA Frank H. Clarke, Director

Operated in close cooperation with the Mathematics Department but with its own board of control. Research activities are in systems theory, analysis, mathematics of decision, graph theory, combinatorics, linear programming, operations research and statistics, mathematical and statistical physics, biology, macroeconomics, and linguistics. Activities at the Center are organized around an annual theme.

Theoretical Physics Group
University of Calgary
Department of Physics
2500 University Drive, NW
Calgary, AB, T2N 1N4 CANADA Phone: (403) 220-5385

Integral unit of Physics Department at University of Calgary. Supported by parent institution, federal and state
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^^^^^^^^^^^^blications and Services: research results published in scientific journals. Sponsors Nonlinear Physics Group weekly seminar. Theoretical physics seminars are held with faculty. Maintains a library on theoretical physics, astrophysics, and plasma physics.

FRANCE

Centre de Recherche Epistemologie et Autonomie:
Ecole Polytechnique
Crea 1 Rue Descartes
Paris, 75005 FRANCE
Jean-Pierre Dupuy

College de Systemique de l'AFCET:
Association Française pour le Cybernetique Economique et Technique
156, Boulevard Pereire
F-75017 Paris, FRANCE President: Jean-Louis Vullierme

The College de Systemique is a division of the French Association for Economical and Technical Cybernetics, AFCET.

Groupe de Recherche en Analyse de System et Economique:
Faculte' d'Economia Applique
3 Avenue Robert Schumann
F-13100 Aix-en-Provence, FRANCE
Jean-Louis le Moique, Director

GERMANY, WEST

Max Planck Institute of Behavioral Physiology:
(Max-Planck-Institut fur Verhaltensphysiologie)
D-8131 Seewiesen, FR GERMANY Phone: 08157-291

Institute is affiliated with the Max-Planck Gesellschaft zur Forderung der Wissenschaften e, V. (Max Planck Society for the Advancement of Science, Residenzstrasse 1a, 8000 Munich 2, FRG). Staff includes 42 research professionals, approx. 40 supporting professionals, and 70 technicians. The institute undertakes

research on the biological and physiological bases of human and animal behavior, including studies of the single organism and its social organization. Scope of interest ranges from the laws governing the behavior of the nature functioning organism to those which govern its acquisition during ontogeny or phylogeny. Principle subjects of study include: 1) temporal organization of behavior (biological clocks); 2) sensory and neural basis of behavior; 3) cybernetic analysis of behavior; 4) acoustical and chemical communication systems; 50 comparative ethology; 6) sociobiology and eco-ethology; and 7) human ethology. Research findings are published in primary journals and in Jahrbuch der Max Planck Gesellschaft (Yearbook of the Max Planck Society). Institute conducts weekly seminars, workshops, and joint lectures and courses in conjunction with the University of Munich.

Max Planck Institute for Biological Cybernetics:
(Max-Planck-Institut fur Biologische Kybernetik)
Spemannstrasse 38 Werner E. Reichardt, Director
D-7400 Tubingen, FR GERMANY Phone: 07071-6011

Institute is affiliated with the Max Planck Gesellschaft zur Forderung der Wissenschaften e. V. (Max Planck Society for the Advancement of Science, Postfach 647, Residenzstrasse 1a, 8000 Munich 2, FRG). Institute staff includes 17 researchers and 27 supporting professionals, 10 technicians and 6 others. Institute conducts research on information processing by the peripheral and central nervous systems. Specific areas of study include: receptor optics and physiology, electrophysiology, and behavior of invertebrates and vertebrates. Research findings are published in primary journals. Institute issues approx. twice a year Biological Cybernetics, published by Springer-Verlag KG., Heidelberg 1, FRG.

Max Planck Institute for Biophysical Chemistry:
(Max-Planck-Institut fur Biophysikalische Chemie)
P.O. Box 968 Hans Strehlow, Director
D-3400 Gottingen-Nikolausberg, FR GERMANY Phone: 0551-2011

Institute is affiliated with the Max Planck Gesellschaft zur Forderung der Wissenschaften e. V. (Max Planck Society for the Advancement of Science, Postfach 647, Residenzstrasse 1a, 8000 Munich 2, FRG). Institute staff includes 158 research professionals, 46 supporting professionals, 151 technicians, and 94 others.

The institute's multidisciplinary research program in biophysical chemistry includes studies involving spectroscopy; laser physics; electrochemistry and reaction kinetics; kinetics of phase transformation; experimental methods; molecular biology; development of molecular systems; biochemical kinetics; biochemistry; neuro-biology. Workshops are maintained for electronics, precision mechanics, repair work, woodworking, and glassblowing. Institute maintains a close association with the University of Gottingen, where Institute staff members conduct courses and give lectures.

Research findings are published in primary journals. Institute publishes Jahrbuch der Max-Planck-Gesellschaft (annual) in German; Berichte und Mitteilungen, and MPG-Spiegel (monthly), in German. Institute holds nuerobiological conference yearly in May and holds other seminars on an irregular basis. Library of 75,000 volumes in biochemistry, physics and neurobiology is maintained.

ITALY

***Centro Milanese di Terapia Cognitiva**
Via Leopardi 19
20123 Milano, ITALIA
Dott. Boscolo, Dott. Cecchin

***Centro Psicoterapia Cognitiva:**
Via degli Scipioni 245
00192 Roma, ITALIA
Dott. Guidano, cognitive psychotherapist and theoritician

***Centro Studi Famiglia:**
Viale Regina Margherita 37
00198 Roma, ITALIA
Dott. Loriedo, Family therapist, hypnotherapist

NETHERLANDS

Institute for Theoretical Biology:
Leyden, NETHERLANDS

IWA:
Research Program in "Support, Survival, and Culture"
Grote Bickersstraat 72
Amsterdam, NETHERLANDS
Gerard de Zeeuw, co-ordinator Ms. Joop Muller

NORWAY

Institute for Information Systems Research:
Norwegian School of Economics
Sandviken
N-5035 Bergen
Gunnar Christensen

POLAND

Institute for Systems Research:
(Instytut Badan Systemowych PAN)
ul. Newelska 6 Roman Kulikowski, Dir.
01-447 Warsaw Phone: 36-44-14
Founded 1977. Research activities in control and optimization theory and applications, methods of systems analysis. Maintains library of 35,000 vols. Publishes "Control and Cybernetics" (quarterly), Prace IBS (continuous), Badania Systemowe (series of monographs).

Institute of Biocybernetics and Biomedical Engineering:
(Instytut Biocybernetyki i Inzynierii Biomedycznej PAN)
ul. Krajowej Rady Narodowej 55 Maciej Nalecz, Director
00-818 Warsaw Phone: 20-64-38
Publishes Biocybernetics and Biomedical Engineering (quarterly), Prace IBiIB PAN.

SINGAPORE

Institute of Systems Science:
National University of Singapore
Heng Mui Keng Terrace
Kent Ridge
Singapore 0511

UNION OF SOVIET SOCIALIST REPUBLICS

Council on Cybernetics:, Armenian SSR Academy of Sciences
ul. Paruyra Sevakal
375044 Yerevan, Armenian SSR, USSR
Chair Acad. R. R. Varshamov

Institute of Biological Physics:
USSR Academy of Sciences
SU-142292, Pushchino, USSR
Krinsky, V. I.

Institute of Cybernetics:, Azerbaijan SSR Academy of Sciences
Dept. of Physical-Engineering and Mathematical Sciences
Baku, ul. Ketskhovel, Kvartal 553
Azerbaijan SSR, USSR
Dept. Director, A. I. Guseynov; Inst. Director, D. E. Allakhverdiev

Institute of Cybernetics:, Estonian SSR Academy of Sciences
Dept. of Physical, Mathematical, and Technical Sciences
200104 Talliin, Lenini puiestee 10
Estonian SSR, USSR
Dept. Dir., E. Lippmaa; Inst. Dir., H. Aben

Institute of Cybernetics:, Ukranian SSR Academy of Sciences
Dept. of Mathematics, Mechanics, and Cybernetics
Kiev, Pr. Letiia Octiabria 142/144
Ukranian SSR, USSR
Dept. Dir., Y. A. Mitropolsky; Inst. Dir., V. M. Glushkov

Institute of Engineering Cybernetics:, Byelorussian SSR Academy of Sciences
Dept. of Physical and Engineering Sciences
Minsk, ul. Surganova 6
Byelorussian SSR, USSR
Dept. Dir., P. I. Jashtshericyn; Inst. Dir., O. I. Semenkov

Scientific Council on Complex Problems:(Cybernetics)
Azerbaijan SSR Academy of Sciences
Baku 1, ul. Kommunisticheskaya 10
Azerbaijan SSR, USSR
Chair, B. A. Azimov

Scientific Research Institute for Applied Mathematics and Cybernetics:
Gorky State University
SU-Gorky, USSR
V.M. Eleonskii, N.E. Kulagin, L.M. Lerman, Ja. L. Umanskii

UNITED KINGDOM

Institute for Cybernetics:
King's College
London SW6 5PR, UK
Haneef Fatmi

UNITED STATES

Biotechnology Laboratory:
University of California, Los Angeles
Department of Materials Science and Engineering
405 Hilgard Avenue; 65 Boelter Hall
Los Angeles, CA 90024 John Lyman, Head

Integral unit of the School of Engineering and Applied Science. Research activities include man-task, man-environment, and biomedical engineering and system theory, including experimental and mathematical studies of human information processing, man-computer interfacing, skilled neuromuscular performance, effects of stress environments, and self-organizing processes.

***Center for Adaptive Systems:**
Boston University, Department of Mathematics
Boston, MA 02215
Gregory O. Stone, Director

Center for Complex Systems Research:
University of Illinois
Stephen Wolfram

Center for Cybernetic Communications Research:
Colorado State University
Room B305; Engineering Research Center Elmar R Reiter, Director
Fort Collins, CO 80523 Phone: (303) 491-8555

Integral unit of Colorado State University. Research field: cybernetic communications. Activities focus on weather forecasting and using artificial intelligence to develop weather prediction systems.

Center for Cybernetic Studies:
University of Texas
CBA 5.202
Austin, TX 78712 A. Charnes, Director

Research activities include manpower management, computational methods in math programming, economic theory, mathematical statistics, financial theory, marketing theory, accounting theory, hydrology, river basin management, and other business and engineering topics concerned with systems or organizations.

Center for Cybernetic Studies in Complex Systems:
Department of Engineering Management
Old Dominion University
Norfolk, VA 23529 Fred Steier, director

"This center conducts both theoretical and applied research, develops training programs, provides consulting services, and publishes groundbreaking material in such areas as computer integrated management systems, expert support systems, decision making in small groups (including project teams), human engineering, and learning systems and technology. "Its functions are to facilitate the administration of faculty/student research projects and to make available to industrial and government organizations in Eastern Virginia the University's facilities and expertise."

Center for Interactive Management:
George Mason University
4400 University Drive; Thompson Hall Alexander Christakis, CIM director
Fairfax, VA 22030 Phone: (703) 323-4107

The Center for Interactive Management, CIM, established by the School of Engineering and Applied Science of the University of Virginia, began operations in

1982. "CIM engages in a mix of teaching, research, and service activities. The top priority of CIM is service, the application and installation of Interactive Management in organizations, both public and private. The second priority is research, primarily aimed at further documentation of fundamentals underlying *the management of complexity* through new and advanced forms of computer-assisted participative design and management. The third priority is teaching, use of what is learned through service and research, in seminars, training courses, and classroom offerings."

Center for Large-Scale Systems:
Purdue University
Lafayette, IN 47907

Center for Nonlinear Dynamics:
University of Texas at Austin — Harry L. Swinney, Director
Austin, TX 78712 — Phone: (512) 471-4619

Integral unit of the University of Texas at Austin. Supported by parent institution, foundations, and industry. Staff includes 8 research professionals, 3 supporting professionals, 7 others. Research activities and fields: Dynamics of systems far from equilibrium. Conducts theoretical and experimental studies of turbulence, reaction-diffusion systems and homogeneous chemical reactions. Special resources: Laser Doppler velocimeters, chemical reactors, a digital imaging system, and associated equipment. Publications and Services: research results published in journals. Holds a weekly Nonlinear Dynamics Seminar and an annual Fall Symposium. Coordinates science and engineering nonlinear dynamics curriculum.

Center for Nonlinear Studies:
Los Alamos National Laboratory
P.O. Box 1663 — Siegfried S. Hecker, Director
Los Alamos, NM 87545 — Phone: (505) 667-5061

Los Alamos National Laboratory is an integral unit of the U.S. Department of Energy, operated by the University of California. Staff: 3,400 research professionals, 4303 others. Operates the Center for Materials Science, Los Alamos Meson Phsycis Facility, Center for Nonlinear Studies, Los Alamos Neutron Scattering Center, Center for National Security Studies, and Institute of Geophysics and Planetary Physics.

Center for Process Studies:
School of Theology
California State University, Claremont College
1325 N. College
Claremont, CA 91711 — David Ray Griffin, Executive Director

"This Center encourages and facilitates the exploration of process philosophy as expressed by Alfred North Whitehead (1861-1947) with special reference to its relation to Christian Thought. "Process theology is examined as an inclusive perspective which integrates the scientific, esthetic, religious, and ethical dimensions of human experience. The Center has sponsored conferences on Biblical Studies, biology, physics, environmental ecology, psychology and Buddhism. Each year ten to twenty visiting scholars contribute their ideas to a growing body of research. The personal papers of the late Daniel Day Williams are housed here, as are the materials on the thought of Charles Hawthorne and John Cobb. *Process Studies*, a scholarly review, is published quarterly by the Center.

Center for Research in Engineering and Advanced Technology:
State University of New York
Watson School of Engineering
Binghamton, NY 13901 — Lyle Feisel, Director

Research activities include engineering and advanced technology. Areas of study have included thermal stress, properties of electrical and mechanical materials,

general systems theory, interpretation of satellite photos, and protein-folding models. Connected with the Systems Science Department.

Center for the Study of Complex Systems:
University of Arizona
Tuscon, AZ 85721

The Center for the Study of Complex Systems is designed to identify and explore new concepts and features of complex nonlinear systems in various areas of science.

Center for Systems Science: Oklahoma St. Univ.
Oklahoma State University
Stillwater, OK 74078

Center for Systems Science: Yale Univ.:
Yale University
Department of Electrical Engineering
P.O. Box 2157
New Haven, CT 06520 Kumpati S. Narendra, Director

Research activities include applications of control and communication theory and signal processing, including adaptive control of engine dynamics, pattern recognition using probabilistic learning methods, and disturbance isolation in flexible space structures. All projects involve mathematical modeling and computer simulation and verification, path planning for robots, and control of robot natural motion via feedback.

Complex Systems Research Center:
University of New Hampshire
Science and Engineering Research Building
Durham, NH 03824 Berrien Moore III, Director

Research activities include simulation modelling of global scale biogeochemical processes, policy analysis, and strategic planning. Fields include global carbon cycle, nitrogen cycling in estuarine-riverine systems, and controlled ecosystems; marine resources; control or disposal of radioactive wastes and effluents from offshore petroleum exploration; risks of coastal energy development; etc.

Control Science and Dynamical Systems Center:
University of Minnesota
127 Vincent Hall; 206 Church Street SE
Minneapolis, MN 55455 Lawrence Markus, Director

The CSDS Center is an integral unit of UM's Institute of Technology. Its research activities are in control systems theory and the theory of dynamical systems. The Center coordinates scholarly and scientific activity at the University and offers postdoctoral fellowships for research in these areas.

Courant Institute of Mathematical Sciences:
New York University
251 Mercer Street Catherine S. Morawetz, Director
New York, NY 10012 Phone: (212) 998-3000

Integral unit of New York University. Supported by U.S. Government, industry, foundations, and professional associations. Staff includes 155 research professionals, 40 supporting professionals, 105 graduate assistants, 20 technicians, 60 others. Research activities and fields include pure and applied mathematics and computer science, including studies on scientific computing, electromagnetic theory, magneto-fluid dynamics, probability, mathematical physics, robotics, software engineering, mathematical biology, wave propagation, and topology. Publications: Communications on Pure and Applied Mathematics (quarterly). Conducts a postdoctoral visitor program. Maintains a library of 53,000 volumes on mathematics.

Ilya Prigogine Center for Studies in Statistical Mechanics:
University of Texas
Austin, TX 78712 Ilya Prigogine, Director
Research activities include nonlinear phenomena in chemical and physical systems and equilibrium statistical mechanics.

Institute for Advanced Study:
Olden Lane Marvin L. Goldberger, Director
Princeton, NJ 08540 Phone: (609) 734-8000
Independent, nonprofit research organization. Supported by endowment income, individual gifts, industry, and research grants from federal, state, and local governments and private foundations. Staff includes 23 faculty members, approximately 160 visiting post-graduate members annually. Research activities and fields are in mathematics, natural sciences, historical studies, and social science, including pure mathematics, theoretical physics, astrophysics, anthropology, Greek archeology and epigraphy, Greek philosophy and philology, paleography, medieval history, modern history, politics and economics, history of art, and history of mathematics and the sciences.

Institute for Cognitive Science:
University of California, San Diego
San Diego, CA 92093

Institute for Interactive Management
University of Pennsylvania
Wharton School
3440 Market Street
Philadelphia, PA 19104

Institute for Nonlinear Science:
University of California, San Diego
San Diego, CA 92093

Institute of General Semantics:
163 Eagle St. Marjorie S. Zelner, Exec. Sec.
Englewood, NJ 07631 Phone: (201) 568-0551
Members include professional or nonprofessional persons, libraries, and business and government organizations. Activities include training, publishing, and consulting in the field of general semantics and non-Aristotelian systems. Sponsors weekend seminars and one-day conferences. Conducts workshops for certification of teachers of general semantics. Maintains library of 2000 volumes on general semantics, philosophy, and sciences. **Publications**: 1) Newsletter, quarterly; 2) General Semantics Bulletin, annual. Holds annual convention with seminar and symposium.

Institute of Safety and Systems Management:
University of Southern California
ISSM-MC 0021
Los Angeles, CA 90089 Hal W. Hendrick, Executive Director
ISSM's research activities include human factors, safety science, systems management, and systems science, including studies of safety and accidents occurring in aviation, agriculture, and motor transportation. Conducts research through the following laboratories: the Head Protection Research Laboratory; the Center for Human Performance Systems; the Decision Support Systems Laboratory; the Industrial Hygiene Laboratory; and the Risk and Emergency Management Laboratory. Offers undergraduate and graduate degrees and short courses through its office of extension

and In-Service Programs, including a systems management curriculum for graduate students.

International Systems Institute:
Far West Laboratory for Educational Research & Development
1855 Folsom Street — Bela Banathy, Inst. Director
San Francisco, CA 94103 — Phone: (415) 565-3000

Far West Laboratory for Educational Research & Development is an independent, nonprofit organization supported by the U.S. Government, state agencies, local government, and foundations. Staff includes 35 research professionals, 30 supporting professionals, plus visiting scholars. Maintains an affiliated center: Southern Service Center (branch office) located at California State University at Northridge, CA. Research activities and fields include new educational technologies, schooling, systems science, communication,dissemination, experience-based learning/career development, equal educational opportunities, preparation of students for adult success, children at risk, early childhood learning, and the relationship of education, work, and productivity. Research results published in reports, articles, and books. **Publications**: ETC: Educational Technology and Communication (monthly). **Services**: Provides professional developmental training for teachers, principles and district level personnel. Sponsors the Educational ComFutures Program dealing with the relationship of computers to education, for school board members and school administrators. Maintains a library.

Lefschetz Center for Dynamical Systems:
Brown University
182 George Street; Providence, RI 02912 — Harold J. Kushner, Director

The Lefschetz Center is an integral unit of the Division of Applied Mathematics with members drawn from diverse fields. Its research activities are in the mathematical theory of dynamical systems, including studies of ordinary and partial differential equations, deterministic and stochastic control theory, operations research, and systems identification. Applications of dynamical system concepts are currently being pursued in a number of research projects involving topics from continuum mechanics, transportation theory, economics, stochastic control and filtering theory, communication theory, mathematical biology, and engineering systems.

National Center for Atmospheric Research:
Box 3000 — Richard A. Anthes, Director
Boulder, CO 80307 — Phone: (303) 497-1000

NCAR is an independent, non-profit research organization operated under sponsorship of the National Science Foundation by University Corporation for Atmospheric Research (UCAR)—a consortium of 54 U.S. and Canadian universities offering graduate programs in atmospheric sciences and related fields. Staff: 800 persons, including 130 research professionals, 200 supporting professionals, 80 technicians, 200 visiting scholars, 190 others.

Research activities and fields include: problems of the atmosphere that are important to society and to scientific progress and that require large coordinated efforts not easily carried out in single universities. Provides service to the university research community and conducts research aimed at achieving a better understanding of total behavior of the atmosphere, including analyzing and predicting atmospheric behavior, establishing solar-terrestrial connections, understanding air chemistry and climate, evaluating environmental and societal effects, and studying connective storms and severe weather. Major projects grouped in several research divisions: Atmospheric Analysis and Prediction Division, Scientific Computing Division, Atmospheric Chemistry Division, High Altitude Observatory, Cloud Storms Division, Atmospheric Technology Division, and Advanced Study Program. Graduate fellowships and postdoctoral research opportunities in atmospheric sciences are administered by its Advanced Study Program.

Publications and Services: Technical Reports; Atmospheric Technology; UCAR Newsletter; NCAR Annual Report; Catalyst (bulletin of abstracts and scientific papers); NCAR Technical Notes. Holds numerous conferences and workshops on selected topics in atmospheric research. Maintains library of 40,000 volumes on meterology, physics, chemistry, mathematics, geophysics, solar science, computer science, and engineering technology.

Salk Institute:
P.O. Box 85800
San Diego, CA 92138
C. Asanuma, F. Crick

Santa Fe Institute:
1120 Canyon Road — L. Michael Simmons, Vice Pres., Academic Affairs
Santa Fe, NM 87501 — Phone: (505) 984-8800

The Santa Fe Institute (SFI) is a private, independent organization dedicated to scientific research, and graduate and post-graduate education in the study of complex systems and their behavior. The initial research programs of the Institute provides a interdisciplinary focus to some of the major concerns and problems of our time, including the world economy, international stability, ecosystem dynamics, and theoretical immunology related to AIDS and the human genome. SFI founders proposed a different type of institution, one free from the rigid departmental structures and narrow specializations that characterize the traditional universities. The goal is to examine the most complex problems of our world in ways that establishes partnerships among those in industry, the academic world, and public life.

SFI has created several interdisciplinary research networks that are functioning and will form the core of the expanding Institute agenda in the years immediately ahead. The members of these networks are giving impetus to the establishment of residential research programs at the Institute and a series of summer schools for advanced graduate students. The courses will gradually evolve into a comprehensive program of graduate education that will provide a training model for the scientists of the future. Support for SFI has come from a select group of government agencies, foundations, corporations, and individuals.

Scientific Reasoning Research Institute:
University of Massachusetts
314 Hasbrouck Lab
Amherst, MA 01003 — J. Lochhead; E. von Glasersfeld

Provides graduate research experience for students interested in a cybernetics or constructivist perspective on physics education. Work in math education is also possible.

Systems Dynamics Group:
Massachusetts Institute of Technology, Sloan School
Room E40-294
Cambridge, MA 02139 — Jay W. Forrester, director

Research activities include system dynamics and its applications in management, economics, ecology, psychiatry, engineering, internal medicine, and energy. Specific research projects include the System Dynamics National Model (economic policy analysis), corporate applications of system dynamics, new management style and systems thinking, system dynamics in education, and system dynamics modeling of arms control. Cooperates with participating private sector organizations in a system dynamics program on corporate and economic change.

System Dynamics Laboratory:
University of Southern California
ISSM, Room 109
Los Angeles, CA 90089-0021 Jack Homer, Director

The System Dynamics Laboratory is an integral unit of the Institute of Safety and Systems Management. Its research activities include defense program life cycle policy, electric utility energy conservation policy, and policy affecting diffusion of new technologies. All projects involve system dynamics simulation modeling and software development, including analysis of dynamic behavior of complex managerial systems and evaluation of alternative policies to improve behavior of such systems.

Systems Research Center:
University of Maryland
Building 093 John S. Baras, Director
College Park, MD 20742 Phone: (301) 454-5673

Center staff includes 79 research professionals, 11 supporting professionals, and 3 others. Center operates in cooperation with the University of Maryland and Harvard University. Center is an interdisciplinary engineering research center of excellence established by the National Science Foundation. Areas of research interest include: chemical process control, expert systems and parallel architectures, manufacturing systems, communication systems and signal processing , and intelligent servo-mechanisms. Center publishes Systems Research Center Technical Research Report Abstracts (annually); and a bimonthly newsletter.

Systems Science Institute:
University of Louisville, Belknap Campus Stephen Merker, Jr., Acting Director
Louisville, KY 40292 Phone: (502) 588-6482

The Systems Science Institute is a teaching, research, and public service unit of the Univ. of Louisville. Utilizing a systems science approach, the Institute conducts research on health systems, living systems, process analysis, energy/environmental and ecological systems, information systems, organizational effectiveness, and social and behavioral systems.

Systems Theory Program:
National Science Foundation, Directorate for Engineering
Electrical, Communications, and Systems
Engineering Division
1800 G St., NW David L Elliot, Program Director
Washington, DC 20550 Phone: (202) 357-7955

This NSF program supports basic research in analytical and computational methods for the analysis, modeling, optimization, and control of natural and man-made systems. Methodologies are applicable to engineering systems analysis and design. Research topics in systems theory range from the very abstract to implementation-oriented algorithmic research. Emphasis is on the engineering applicability of the techniques to *interconnected complex large-scale problems*. Modeling, estimation, analysis, optimization, and control of large-scale systems are emphasized, and scheduling, routing, and queueing in large-scale processes or network systems are stressed. Major research areas are methodological and may have applications to a large variety of complex engineering systems, and robotic systems. Awards are granted in: control systems; optimization techniques; scheduling, queueing, and network systems; and systems analysis, modeling, identification, and estimation.

3. Societies, Associations & Organizations

DESCRIPTION: This section contains Societies, Associations, and Organizations concerned with general systems and cybernetic research. Entries marked with a sword (†) indicate membership in IFSR, the International Federation for Systems Research (Vienna, Austria).

ARGENTINA

Asociation Argentina de Teoria General de Sistemas y Cibernetica:†
Embajada de Belgia; Defensa 113-8 OP.
1065 Buenos Aires, ARGENTINA
Charles François, President

AUSTRIA

Austrian Society for Cybernetic Studies†
Österreichische Studiengesellschaft für Kybernetik (ÖSGK)
Schottengasse 3
A-1010 Vienna; AUSTRIA Robert Trappl, President
Publications: Cybernetics and Systems

International Federation for Systems Research (IFSR):
Schottengasse 3 Robert Trappl, President
A-1010 Vienna, AUSTRIA Phone: 222/6632810
Languages: English. Founded in 1979. Organizations involved in the scientific study of systems. Coordinates systems research on an international level. Organizes meetings, courses, and workshops. Promotes publication of materials on systems research. Sets standards and levels of competence in systems research education. **Publications**: 1) Systems Research (English), quarterly; 2) IFSR Newsletter, periodic; also publishes ISFR Book Series.

International Institute for Applied Systems Analysis, IIASA:
Schlossplatz 1 Thomas H. Lee, Director
A-2361 Laxenburg, AUSTRIA Phone: 2236 715210
Founded in 1972. Members are national academies of sciences or national scientific committees. Purposes are to: evaluate and solve problems caused by science and technology; develop and formulate systems analyses; promote the use of analytical techniques necessary to the study of complex problems; inform and educate those who may effectively employ the institute's findings. Serves as networking agent for international, cooperative research. Conducts research on system and decision sciences, technological development and its impact on economy and society, population, and the environment. Holds conferences and workshops; sponsors lectures; maintains the Young Scientists' Summer Program. FAX, 2236 71313; Telex, 079137 iiasa a. **Publications**: 1) IIASA-This Month (newsletter); 2) Options (journal), quarterly; 3) Annual Report; also publishes books, reports, lectures, and conference proceedings.

BELGIUM

International Association for Cybernetics:, (IAC)
Palais des Expositions
2, rue Sergent Vrithoff Jean Ramaekers, Managing Director
B-5000 Namur, BELGIUM Phone: 81 735203
Languages: English, French. Founded in 1957. Scientists and industrial firms operating in 42 countries. Aims are to: ensure organized and permanent liaison

among research workers in different countries concerned with various sectors of cybernetics; promote development of the science and its technical applications; disseminate information concerning achievements in the field. Telex: 59101. **Publications**: 1) Cybernetica (journal), quarterly; 2) Proceedings of International Congress, triennial; 3) Cybernetics:Work in Progress, irregular. Convention/Meeting: triennial congress, next in 1989.

SOGESCI - B. V. W. B. †
Rue de la Concorde 51
B-1050 Bruxelles, BELGIUM
Chr. de Bruyn, general manager

FRANCE

Association Française pour le Cybernetique Economique et Technique:
156 Péreire Blvd.
F-75017 Paris FRANCE
Jean-Louis Vullierme, President

Club of Rome:
56 ter, rue Perronet;
F-92200 Neuilly-sur-Seine, FRANCE
c/o Bertrand Schneider

World Organization of Systems and Cybernetics:
Organization Mondiale pour la Systémique et la Cybernétique, WOSC-OMSC**:**
(Formerly World Organization of General Systems and Cybernetics)
2, Rue de Vouillé Robert Vallée, Director General
F-75015 Paris, FRANCE Phone:

President in Memoriam: Norbert Wiener. President: Stafford Beer. Honorary Director and Founder: J. Rose.

Languages: English and French. Founded in 1969. National societies interested in cybernetics, general systems, operational research, automation, robotics, computer science, artificial intelligence, and related areas. Objectives are: to sponsor national and international activities in the fields of cybernetics systems and generate interest in related disciplines; to weed out psuedo-cybernetic claims and base cybernetics on sound scientific foundations. Publishes studies on topics such as automation, cybernetics modeling, computer simulation, biocybernetics, economic and social systems, nature and validation of general systems, ecosystems, adaptive systems, and the philosophy of cybernetics. Conducts national and international seminars, conferences, congresses, and exhibitions. Acts as clearinghouse on robotics and promotes its development. Holds annual essay competition; bestows Norbert Wiener Gold Medal triennially; maintains hall of fame. Sponsors International Congress of Cybernetics and Systems. **Publications**: 1) *Automation and Robotics Times*, monthly; 2) *Kybernetes*, quarterly; 3) *Robotica*, quarterly; also publishes proceedings, monographs, and books. Affiliated with Institute of Electrical and Electronics Engineers. Convention/Meeting: triennial congress, next in 1990.

GERMANY, WEST

Gesellschaft für wirtschafts- und Sozialkybernetik:(GWS) †
Universitätsstrasse 14/16
D-4400 Münster, FR of GERMANY
J. Baetge, director general

Internationale Gesellschaft für systemische Therapie:
Scholßhof 3
D-6908 Wiesloch; FR of GERMANY
tel. 06222/81880

World Association of Cybernetics, Computer Science, and System Theory:
Institut für Linguistik
Ernst-Ruter-Platz 7 Dan Maxwell, Sec.
D-1000 Berlin 10, FR GERMANY Phone: 30 3143219
Languages: English, Esperanto, French. Founded in 1984. Individuals and associations concerned with cybernetics. Participates in research involving cybernetics; represents cyberneticists before scientific groups and institutions. **Publications**: 1) GrKG/Humankybernetik (includeds membership directory, in English, Esperanto, French, and German), quarterly; 2) InternaciaKomputado (in Esperanto), quarterly. Affiliated with: International Association for Cybernetics (BELGUIM).

GREECE

Greek Systems Society†
82 Fokionis Negri Street
Athens 11361, GREECE
Micheal Decleris, managing director

INDIA

Society of Management Science & Applied Cybernetics:(SMSAC) †
O. R. Unit, C. S. I. R. Complex, N.P. L.
Campus, New Delhi, 110012 INDIA
A. Ghosal, secretary

MEXICO

Mexican Association of Systems and Cybernetics: †
Asociacion Mexicana de Sistemas y Cibernetica, A.C.
Antonio Sola 43
Mexico 11, D.F. MEXICO
J. L. Elohim, presidente

Instituto Mexicano de Sistemas, A.C.: †
Apdo. Postal 20276, Admon de Correos
Deleg. Alvaro Obregon
01000 Mexico, D.F. MEXICO
Jorge Diaz Padilla, presidente

NETHERLANDS

European Society for the Study of Cognitive Systems:
c/o Institute for Experimental Psychology
University of Groningen
P.O. Box 14
9750 AA Haren, Netherlands.

The Netherlands Society for Systems Research:†
(Systeemgroep Nederland)
Katholieke Hogeschool Tilburg
Hogeschoollaann 225
Tilburg, NETHERLANDS K. A Sondyn, secretiariat

The Netherlands Society for Systems Research (Systeemgroep Nederland) was founded in 1970 to promote scientific activity based on a systems approach. Most of the 250 members of the Systeemgroep Nederland are priveate individuals while there are some institutions or companies in the membership. The Systeemgroep Nederland organizes lectures and summer courses. It maintains working groups on systems methodology, social systems, biological systems etc. Publications: "Nieuwsbrief" (newsletter) contains announcements and summaries of lectures, conferences, and book reviews; "Annals of Systems Research" contains papers published in the field of general systems research and research reports on special subjects which are of importance for the development of systems research activity as a whole.

POLAND

Polish Cybernetic Society:†
(Polskie Towarzystwo Cybernetyczne)
Dept. of Praxiology, Design Methodology Unit
Polish Academy of Sciences
Nowy Swiat Str. 72
00-330 Warsaw, POLAND Wojciech Gasparski

The Polish Cybernetic Society (PCS) was founded in 1962 as a social association acting under the auspices of the Polishc Academy of Sciences. The Executive Committee and the Scientific Council of the PCS are located in Warsaw, with branch offices in Gdansk, Krakow, Lodz, Poznan, Radom, Torun, Warsaw and Wroclaw. PCS membership (as of 1977) is 800, mainly comprised of representatives of scientific centres and schools of higher learning, as well as practicians from economic organizations and government agencies.

The Polish Cybernetic Society is the only multidisciplinary association in Poland. Its aim is to promote the development of cybernetic disciplines and to popularize their theoretical foundations and practical applications in the economic and cultural life of the country. Scientific activities are conducted primarily by sections* dealing with particular problems. They include organizing conferences, scientific discussions and seminars, inspiring publication of monographs and regular scientific contacts with schools of higher learning and scientific centres. At present (1977) the following sections* operate: 1) Bio-cybernetics, 2) technical cybernetics, 3) pedagogic cybernetics, 4) economic cybernetics, 5) heuristics, and 6) informatics.

SPAIN

Sociedad Española de Systemas Generales:†
Dr. Gomez Ulla, 4
28028 Madrid, SPAIN
Rafael Rodriguez Delgado, president

UNITED KINGDOM

Cybernetics Society, The:†
c/o School of Pharmacology
Brunswick Square
London WCI, ENGLAND, UK
Brian Warburton, vice-chairman

United Kingdom Systems Society†
Staff Flats, Broomgrove Hall
9 Broomgrove Road
Sheffield S10 2LW, ENGLAND, UK
Nimal Jayaratna, chairman

UNITED STATES

American Society for Cybernetics†
c/o Department of Decision Sciences
George Mason University — Stephen Ruth, President
Fairfax, VA 22030 — Phone: (703) 323-2738

The American Society for Cybernetics consists of persons with professional standing or interest in the field of cybernetics. The Society fosters projects in theoretical and applied cybernetics by means of multidisciplinary scientific conferences and research programs; publishes and disseminates the results of studies in cybernetics. It encourages education in cybernetics in schools and universities, fosters public understanding of cybernetics, of its benefits and implications. The Society also sponsors symposia and workshops. **Publications**: 1) newsletter, monthly; 2) Cybernetic, quarterly; 3) Conference Proceedings, annual; also publishes Glossary of Cybernetics and Systems Theory.

Association for Integrative Studies:
School of Interdisciplinary Studies
Miami University — Bill Newell, Secretary-Treasurer
Oxford, OH 45056 — Phone: (513) 529-2213

The Association for Integrative Studies (AIS) was founded in 1979 to promote the interchange of ideas among scholars and administrators in all of the arts and sciences on intellectual and organizational issues related to furthering integrative studies. The Association serves as an organized voice and a national source of information on integrative and interdisciplinary approaches to the study of human experience. The Association strives 1) to articulate the nature of integrative and interdisciplinary studies and to document their importance for higher education and for society; 2) to enhance research and teaching in integrative studies by promoting the development of interdisciplinary theory, methodology, and curriculum design; 3) to maintain a communications network for the exchange of scholarly and pedagogical information on integrative studies; 4) to establish standards of excellence for the conduct of integrative studies in research and teaching.

Members of AIS are faculty engaged in interdisciplinary teaching and research or who are interested in exploring interdisciplinary topics and methodology, and administrators of integrative colleges, schools, programs, and courses. **Publications**: AIS Newsletter, quarterly; *Directory of Selected Interdisciplinary Undergraduate Programs in the United States*. Forthcoming is a directory of selected graduate programs. **Services**: AIS sponsors an annual conference at a campus with an interdisciplinary program. Conference sessions address the nature and limits of interdisciplinary relations to and among the disciplines, tensions between applied and theoretical knowledge, the aims and forms of interdisciplinary teaching, problems in

administering interdisciplinary programs, and discussions of research in specific areas such as science and society, sociology, psychohistory, international or cultural studies.

Association for Systems Management:
24587 Bagley Road Richard L. Irwin, CAE, Exec. Dir.
Cleveland, OH 44138 Phone: (216) 243-6900

Founded 1947. Members: 9000. Staff: 16. Local Groups: 108. International professional organization of administrative executives and specialists in management information systems work serving business, commerce, education, government, and the military, and concerned with communications, electronics, equipment, forms control, human relations, organization, procedure writing, and systems applications. Offers one, two, and three-day seminars and conferences, and five-day courses in all phases of administrative systems and management. Bestows awards. Maintains 800 vol. library on administrative systems and business management. **Publications**: Journal of Systems Management, monthly; also publishes monographs, statistical reports, and a college textbook. Formerly: (1968) Systems and Procedures Association.

Elmwood Institute:
P.O. Box 5805 Fritjof Capra, Director
Berkeley, CA. 94705 Phone: (415) 845-4595

The Elmwood Institute organizes and sponsors conferences, symposia, and public dialogues to promote systems thinking and the systems view of the world. "The Elmwood Institute was founded to facilitate the cultural shift from a mechanistic and patriarchal worldview to a holistic and ecological view. Its purpose is to nurture new ecological visions—based on awareness of the fundamental interdependence of all phenomena and of the embeddedness of individuals and societies in the cyclical processes of nature—and to apply these visions to the solution of current social, economic, environmental, and political problems. Elmwood organizes gatherings of innovative thinkers, policy makers and grassroots organizers—women and men who shape our society in many ways but who rarely, if ever, have the opportunity to talk to each other. At Elmwood gatherings unique dialogues take place, new ideas are conceived, and strategies for change are born. These discussions are recorded, and edited transcripts or audio and videotapes are made available to Elmwood members before publication and broader discussion." **Publications**: The Elmwood Newsletter, quarterly.

IEEE Systems, Man, and Cybernetics Society:
c/o Institute of Electrical and Electronics Engineers
345 East 47th St.
New York, NY 10017 Phone: (212) 705-7867

IEEE Systems, Man, and Cybernetics Society serves as a forum on the theoretical and practical considerations of synthetic and natural systems involving humans and machines. **Publications**: Transactions on Systems, Man, and Cybernetics; bimonthly.

International Society for General Semantics:
P.O. Box 2469 Exec. Dir. Russell Joyner
San Francisco, CA 94126 Phone: (415) 543-1747

The Society consists of approx. 2200 members among whom are educators, business and professional people, scientists, and others interested in general semantics and improving communication. The aim of the Society is to advance knowledge and inquiry into non-Aristotelian systems and general semantics through publications, lectures, and research. **Publications**: 1) Et Cetera: A Review of General Semantics, quarterly, 2) Glimpse, quarterly; also publishes books, texts, and films in the field of general semantics and improving communication. Holds international conference every two to three years; also holds annual seminar.

International Society for the Systems Sciences:, ISSS †
(formerly, International Society for General Systems Research)
International Business Office
Church Street Station — Rod Swenson, managing director
New York, NY 10008-3586 — Phone: (212) 732-8831

The International Society for Systems Sciences (ISSS) consists of approx. 1000 members among whom are mathematicians, physical scientists, engineers, psychologists, social scientists, psychiatrists, medical researchers, and others interested in general systems research. The Society encourages development of theoretical systems which are applicable to more than one of the traditional departments of knowledge. Its functions include: to investigate isomorphy of concepts, laws, and models in various fields and help in useful transfers from one field to another; to encourage development of adequate theoretical models in fields which lack them; to minimize duplication of theoretical effort in different fields; to promote unity of science through improving communication among scientists. The Society bestows a student scholarship award and an outstanding leadership award, sponsors competitions, and maintains a speakers' bureau and library. (Originally named: Society for the Advancement of General Systems Theory.) **Publications**: 1) General Systems Bulletin, annual; 2) General Systems Yearbook, 3) Proceeding of Annual Meetings, 4) Managing Director's letter, irregular, 5) Proceedings of Regional Meetings, irregular.

Medical Cybernetics Foundation:
P.O. Box 16324 — Robert C. Frost, President
Jacksonville, FL 32245 — Phone: (904) 262-9248

Founded: 1985. Members: 1000. Staff: 4. Medical and medically-affiliated professionals. To assist members in researching, developing, and marketing new medical machinery such as monitoring equipment and robotics systems; to improve life through medical cybernetics. (Medical cybernetics refers to the relationship between machinery and medical practices and procedures.) Maintains 5000 volume library on engineering and medicine. Sponsors charitable program; bestows awards. Compiles statistics. **Publications**: none.

Polanyi Society:
Department of Religion and Philosophy
Stephens College — Richard Gelwick, coordinator
Columbia, MO 65215 — Phone: (314) 876-7143

One hundred members consisting of college and university faculty, graduate students, and other individuals interest in the thought of Michael Polanyi (1891-1976), British chemist and philosopher. Polanyi is best known for his research in X-ray analysis, thermodynamics, and reaction kinetics; however, he later turned to social studies and philosophy and published works, including *Beyond Nihilism*, and *Scientific Thought and Social Reality*. Serves as a communication network among members. Conducts education programs. Divisions: Art Studies; Communication and Rhetorical Studies; Education Studies; Medical and Psychiatric Studies; Philosophy Studies; Religious Studies. Publications: 1) Tradition and Discovery (journal), semiannual; 2) Newsletter, periodic. Holds annual conference in the summer.

Society for the Study of Process Philosophies:
Department of Philosophy
Dickinson College — George Allan, Coordinator
Carlisle, PA 17013 — Phone: (717) 245-1321

The society consists of scholars in philosophy and related fields with a specialty or interest in process thought. Holds periodic meetings to discuss working papers prepared by members. Conducts semiannual seminar/symposium. Meetings are in conjunction with other national professional meetings, such as the American Philosophical Association and the Metaphysical Society of America. The society

circulates, through its mailing list, papers to be discussed, other papers of interest, and information concerning relevant projects.

System Dynamics Society:
Massachusetts Institute of Technology
E40-294
Cambridge, MA 02139 USA

4. People in the Systems Sciences

DESCRIPTION: This section is a first attempt to collect information on people who teach, research, publish, or otherwise work in the systems sciences and sciences of complexity. People listed here do not necessarily call themselves "systems scientists" or "cyberneticians"; many work in areas such as linguistics, computer and information science, physics, chemistry, biology, medicine, psychology, economics, sociology, etc.—i.e. traditional fields where they have employed a systems approach. This section is subject to be outdated rather quickly as people move around and is not intended to be a complete list.

NOTE: My apologies to those persons who are active contributors to complex systems science and are not yet listed here. If you would like to be represented here (or know of someone else who should), please send a short profile of yourself describing your involvment in systems science containing information about your, 1) position, 2) areas of expertise, 3) research interests, and 4) address to: Systems Education Research, 8111 Ellison NW, Olympia, WA 98502, USA.

AUSTRALIA

Cade, Brian
- Family Therapy, Sydney.

Kaye, John
- Family Therapy, Adelaide.

White, Michael
- Family Therapy, Adelaide.

AUSTRIA

Grossing, Gerhard
- Atominstitute; Schuttelstrasse 115; Vienna

Lee, Thomas.
- Director: International Institute for Applied Sysems Analysis; Schlossplatz 1; A-2361 Laxenburg.

Pichler, Franz
- Deparment of Systems Science; Johannes Kepler University Linz; A-4045 Linz.

Shuster, Peter
- Institute for Theoretical Chemistry; University of Vienna; A-8010

Trappl, Robert.
- Director: Institute for Medical Cybernetics, University of Vienna; A-1010 Vienna.
- President: Austrian Society for Cybernetic Studies

BELGIUM

Allen, Prof.
- Service de Chimie Physique II; Code Postal #231; Campus Plaine U.L.B.;
- Boulevard du Triomphe; 1050 Bruxelles

Elkaim, Mony
- Square des Nations 5; 1050 Bruxelles

Nicolis, G.
- Service de Chemie Physique; Code Postal No. 231 Campus Plaine U.L.B.
- Boulevard du Triomphe; 1050 Bruxelles

Prigogine, Ilya
- Free University of Brussells, BELGIUM.
- Ilya Prigogine Center for Studies in Statistical Mechanics; University of Texas; Austin, TX USA.

Ramaekers, Jean.
- Managing Director: International Association for Cybernetics.

CANADA

Boyd, Gary
- Faculty: Educational Technology Department; Concordia, University; 1455 de Maisonneuve Boulevard West; Montreal, QUEBEC H3G 1M8.

Bunge, Mario
- Foundations and Philosophy of Science Unit, McGill University, Montreal, Canada.
- Instituto de Investigaciones Filosóficas, U.N.A.M., México.

Clarke, Frank H.
- Director: Centre de Recherches Mathematiques, University of Montreal; C.P. 6128-A; Montreal, PQ.

Doutriaux, Jérome
- Chairman: Systems Science Programme, University of Ottawa; Ottawa, Ontario, K1N 9B5.

Forsythe, Kathleen
- Snowflake Communications. 1030 Richmond Ave; Victoria, BC V85 3Z5.

Holling, C. S.
- Institute of Animal Resource Ecology, Department of Zoology; University of British Columbia; Vancouver, VGT IW5.

Jung, Richard.
- Center for Systems Research; University of Alberta; 5-21 Tory; Edmonton, ALBERTA, T6G 2H4.

Milsum, John
- Faculty; Division of Health Systems, University of British Columbia; #400 - 2194 Health Sciences Mall; Vancouver, B.C. V6T 1Z6.

Rosen, Robert
- Department of Physiology and Biophysics, Faculty of Medicine, Dalhousie University, Halifax, Nova Scotia.

Thom, Karl
- Professor of Psychiatry, Faculty of Medicine; University of Calgary. University of Calgary Medical Center; 3350 Hospital Rd. NW; Calgary T2N 4N1.

CHILE

Maturana, Humberto
- Biology Department; University of Santiago; Santiago de CHILE

DENMARK

Pruzan, Peter
- Chairman: Department of Applied Computer and Systems Sciences, Copenhagen School of Economics and Business Administration; Julius Thomsens Plads 10; 1925 Copenhagen C.

FINLAND

Kohonen, Teuvo
- Helsingin Tekninen Korkeakoulu
- Associative memory, neural networks

Pantzar, Mika
- Labor Institute for Economic Research
- Hämeentie 8A; 05300 Helsinki 53

Sandelin, Singa
- Kasvatustieteen Laitos
- Bulevardi 18; 00500 Helsinki

FRANCE

Andreewsky, Evelyne
-

Atlan, Henri
- CREA, Ecole Polytechnique; 1 Rue Descartes; Paris, 75007

Bernard-Weil, Elie
-

Dupuy, Jean-Pierre
- CREA, Ecole Polytechnique; 1 Rue Descartes; Paris, 75007

Karsky, M.
-

Lesourne, Jacques
-

Moigne, Jean-Louis le
-

Morin, Edgar
-

Tabany, Jean-Claude
-

Thom, Rene
-

Vallée Robert
- Director General: World Organization of Systems and Cybernetics
- 2, rue de Vouillé; F-75015 Paris.

Varela, Francisco
- CREA, Ecole Polytechnique; 1 Rue Descartes; Paris, 75007

Vullierme, Jean-Louis
- President: College di Systemique de l'Association Française pour la Cybernetique Economique et Technique.
- 156, Blvd. Péreire; F-75017 Paris.

Walkowski, Zbigniew
-

Walliser, Bernard
-

GERMANY, EAST

Ebeling, Werner
- Sektion Physik, Humbolt Universität
- Invalidenstr. 42; DDR-1040 Berlin

Feistel, Heinz
- Sektion Physik; Wilhelm-Pieck-Universität
- Universitätsplatz 3; DDR-2500 Rostock

Peschel, Manfred
- Faculty: Department of Mathematics/Cybernetics, Academy of Sciences of the GDR; Rudower Chaussee 5; 1199 Berlin-Alderhof, GDR

GERMANY, WEST

Bauersfeld, Heinrich
- Universität Bielefeld; Postfach 8640; D-4800 Bielefeld 1; FRG

Eigen, Manfred
- Max Planck Institute for Biophysical Chemistry; Karl-Friedrich-Bonhoetter-Institute;
- Am Fassberg Georg-Dehio-Weg 14; D-3400 Göttingen; Nikolausberg, FRG

Haken, Hermann
- Institut für Theoretische Physik der Universität Stuttgart; Pfaffenwaldring 57/1V; D-7000 Stuttgart 80; FRG
- dynamical systems theory; self-organizing systems; synergetics.

Hargens, Jürgen
- editor "Zeitschrift für systemische Therapie"
- Norderweg 14, D-2391 Meyn; Phone: 0 46 39 / 75 06

Hejl, Peter M.
- Universität Siegen; Hölderlinstr. 3; D-5900 Siegen 21

Küppers, Günter
- Universität Bielefeld; Postfach 8640; D-4800 Bielefeld 1; FRG

Maxwell, Dan
- Sec.: World Association of Cybernetics, Computer Science, and System Theory

Peitgen, Heinz Otto
- Universität Bremen; Fakultät für Physik; Postfach 33040; D-2800 Bremen; FRG
- dynamical and nonlinear systems; computer imaging.

Richter, Peter
- Universität Bremen; Fakultät für Physik; D-2800 Bremen; FRG

ITALY

Ceruti, Mauro
- Via S. Alessandro 69A; 24100 Bergamo
- Epistemologist; Faculty member in the Psychology Dept. of University of Palermo, Sicily

Ricciardi, Luigi M.
- Institute for Information Sciences, University of Salerno, Via Vernieri 42, I-84100, Salerno.

Telfener, Umberta
- Piazza Del Ricci 129; Rome, 00186

NETHERLANDS

Sondyn, K. A.
- Secretiariat: Systeemgroep Nederland

Zeeuw, Gerard de
- University of Amsterdam; Grote Bickerstraat 72; NL Amsterdam 1013 KA

Zouwen, Johannes van der
- Department of Research Methodology; Free University of Amsterdam.

NORWAY

Anderson, Tom
- University of Tromsø; ISM, P.O. Box 417;
- N-9001 Tromso

Braten, Stein
- University of Bergen, Dept. of Cognitive Psychology;
- Syneshaugen 2; N-5007 Bergen.

POLAND

Gasparski, Wojciech
- Polish Cybernetic Society; Dept. of Dept. of Praxiology, Design Methodology Unit; Polish Academy of Sciences; Nowy Swiat Str. 72; 00-330 Warsaw, POLAND.

SWEDEN

Lofgren, Lars
- University of Lund; Building E; Box 725; 22007 Lund; SWEDEN.

Samuelson, Kjell
- University of Stockholm, Royal Institute of Technology.

SWITZERLAND

Dachler, H. P.
- Hochschule für Wirtschafts- und Sozialwissenschaften
- Dufourstr. 50; CH-9000 St. Gallen.

Piaget, Jean Archives
- Center for Genetic Epistemology; University of Geneva.

UNION OF SOVIET SOCIALIST REPUBLICS

Krinsky, V. I.
- Institute of Biological Physics, USSR Academy of Sciences, SU-142292, Pushchino, USSR.

Tsypkin, Y. Z.
- Institute of Control Sciences, USSR Academy of Sciences, 81 Profsoyuznaya, Moscow 117343, USSR.

UNITED KINGDOM

Beer, Stafford
- University of Manchester; Manchester, M 13 9 PL, Lancashire; UK
- University of Pennsylvania; Social Systems Science M.S., Ph.D. Program.
- Cwarel Isaf, Pont Creuddyn, Lampeter, Dyfeed, Wales, England.

Checkland, Peter
- Department of Systems; School of Management and Organizational Studies, University of Lancaster

Espejo, Raul
- Management Centre; Aston University; Aston Triangle; Birmingham B4 7ET

Flood, Robert
- The City University; Department of Systems Science
- Northhampton Square, London, EC1V OHB, UK

Glanville, Ranulph
- Portsmouth Polytechnic; Architecture Dept.; 52 Lawrence Road; Southsea Hants, PO5 1NY

Goodwin, Brian
- Department of Biology, The Open University, UK.

Jackson, Mike
- University of Hull; Department of Management Systems and Sciences
- Hull, HU6 7RX, UK

Jayaratna, Nimal
- Chairman: United Kingdom Systems Society; Staff Flats, Broomgrove Hall; 9 Broomgrove Road; Sheffield S10 2LW, ENGLAND, UK

Mayan-White, William
- Professor: Systems Management Program, Open University; Walton Hall, Milton Keynes; Bucks, MK7 6AA.

Pask, Gordon
- System Research Ltd.; Sheen Road; Richmond, Surrey, England.
- 61 Kings Road, Kingston upon Thames, Surrey KT2 5JA.

Rose, John
- Honorary Director and Founder: World Organization of Systems and Cybernetics; 2, Rue de Vouillé, F-75015 Paris, FRANCE.

Warburton, Brian
- Vice-Chairman: The Cybernetics Society; c/o School of Pharmacology; Brunswick Square; London WCI, ENGLAND, UK

Zeeman, Christopher
- Mathermatics: catastrophe theory.

UNITED STATES

Abraham, Ralph
- Division of Natural Sciences, University of California; Santa Cruz, CA
- dynamical systems research, mathematics, epistemology.

Ackermann, Edith
- M.I.T., Cambridge, MA

Ackoff, R. L.
- Graduate Faculty; Social Systems Science Program; Wharton School; Univ. of Pennsylvania, 1150 Stemberg Hall, Philadelphia, PA 19104.

Arrow, Kenneth J.
- Department of Economics, Stanford University

Axelrod, Robert.
- University of Michigan
- Political Science.

Banathy, Bela
- Director: International Systems Institute, Far West Laboratory for Educational Research and Development; 1855 Folsom Street, San Francisco, CA 94103.
- Executive Faculty: Saybrook Institute, 1772 Vallejo Street, San Francisco, CA 94123.

Ben-Eli, Michael
- 345 East 86th Street; New York, NY 10028 USA

Boulding, Kenneth E.
- Institute of Behavioral Science; University of Colorado; C. Box 484, Boulder, CO 80309-0484 USA

Bloch, Donald A.
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- Head: Department of Physics, University of Arizona.

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- Fordham University, Lincoln Center; Division of Social Sciences, New York, NY 10023.

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- President: Santa Fe Institute; Senior Fellow, Los Alamos National Laboratory.

Crutchfield, James P.
- dynamical systems research; chaos theory, nonlinear systems.

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- dynamical systems research; chaos theory, nonlinear systems.

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- Director: Institute for Population and Research Studies, Stanford University.

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- Georgia Institute of Technology.
- complex dynamical systems and chaos research.

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- Professor; Systems Science Department; State University of New York; Binghamton, NY 13901

Gell-Mann, Murray
- Division of Physics and Astronomy, California Institute of Technology.

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- Director: Center for Process Studies, California State University, Claremont College; 1325 N. College; Claremont, CA 91711.

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Kraft, Donald H.
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- Systems Science Ph.D. Program; Portland State University; P.O. Box 751, Portland, OR 97207.

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Lorentz, Edward N.
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- Chairman: Department of Engineering-Economic Systems, Stanford University, School of Engineering; Stanford, CA 94305.

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Markus, Lawrence
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- Director: Courant Institute of Mathematical Sciences, New York University; 251 Mercer Street; New York, NY 10012.

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- Department of Biophysics and Biochemistry, Yale University.

Nelson, Harold.
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- architecture; systems design; self organizing processes.

Newell, Allen
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Norman, Donald A.
- Institute for Cognitive Science, University of California, San Diego; La Jolla, CA 94040.
- parallel distributive processing research

Odum, Howard T.
- Department of Environmental Engineering Science; Univ. of Florida; Gainsville, FL 32611
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Olfe, D. B.
- Chairman: Department of Applied Mechanics and Engineering Sciences, University of California, San Diego; 4103B Engineering Building, Unit 1; Warren College; San, Diego, CA.

Pangaro, Paul
- Pangaro Inc.; 800 Third Street NE; Washington, DC 20002 USA
- Sotftware development using AI hardware and cybernetic techniques.

Packard, Norman H.
- University of Illinois.
- dynamical systems and chaos research.

Pattee, Howard H.
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- Modeling of biological systems, cognitive theory, evolutionary models of complex systems, linguistic control of dynamic systems.

Pines, David
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Powers, William
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Reckmeyer, William
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- Chair, Institute of Systems Science, University of Louisville.

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- Department of Psychology, Stanford University; Institute for Cognitive Science, University of California, San Diego.
- cognitive science: parallel distributive processing research

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- Department of Decision Sciences, George Mason University.
- President: American Society for Cybernetics.

Schneider, Stephen
- Deputy Director: Advanced Study Program, National Center for Atmospheric Research.

Sejnowski, Terence
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Shaw, Robert S.
- University California, Santa Cruz.
- dynamical systems theory and research

Simmons, L. Michael
- Vice President: Santa Fe Institute; Los Alamos National Laboratory.

Simon, Herbert
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Sinisi, Vito F.
- Director: Graduate Program in Philosophy and Computer and Systems Sciences; Department of Philosophy, State University of New York; Watson School of Engineering; Vestal Parkway; Binghamton, NY 13901.

Smale, Steven
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- Department of Computer Science; University of Colorado; Boulder, CO 80309.
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Steier, Frederick
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- Department of Biological Sciences; California State Polytechnic University, Pamona; Pamona, CA
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- Center for Complex Systems Research, University of Illinois.

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- Theoretical Division, Los Alamos National Laboratory.

Zwick, Martin.
- Director: Systems Science Ph.D. Program, Portland State University.

Reference

5. Publications: Periodicals

DESCRIPTION: Major journals, yearbooks, proceedings, transactions, collections of papers, in the sciences of complexity. These publications are divided into four categories: A) Cybernetics and General Systems Research, B) Natural Science, C) Cognitive and Social Sciences, and D) Information and Computer Sciences; Engineering. The categories overlap in many ways but should direct the user more quickly to the area of interest. It is not intended to be a complete list.

A. Cybernetics and General Systems Research

(see also section D below)

Advances in Cybernetics and Systems. International Congress of Cybernetics and Systems. Oxford University, 1972, John Rose, Ed. London and New York: Gordon and Breach: 1974, 3 vols.

Advances in Cybernetics and Systems Research. Proceedings of the European Meeting on Cybernetics and Systems Research, Vienna, Austria, 1972. F. de P. Hanika, Ed. London: Transcripta Service and Books; 1973.

American Society for Cybernetics: Proceedings of the Annual Symposium. irregular. American Society for Cybernetics, George Mason University, Department of Decision Sciences, Fairfax, VA 22030.

Analyse de Systeme. Centre d' Etude et de Recherche de Gertion; 16 quoi Claude Bernard, F-69007 Lyon, France.

Annals of System Research. R. Van Rootselaar, Ed. Leiden: Netherlands Society for Systems Research; 1971-.

Behavioral Science. Journal of the Society for General Systems Research. James G. Miller, editor, P.O. Box 8369; La Jolla, CA 92038-8369 USA. Business Office: P.O. Box 64025; Baltimore, MD 21264 USA

Biocybernetics. Proceedings of the International Symposium on Biocybernetics, 1967-1969. H. Drischel, Ed. Jena: G. Fischer; 1967-.

Biological Cybernetics (continues **Kybernetic**). communication and control in organisms and automata. 12 per year. W. Reichardt, Editor. Berlin and New York: Springer Verlag; 175 Fifth Ave., New York, NY 10010.

Communication and Cybernetics. irregular. Springer Verlag; 175 Fifth Ave., New York, NY 10010. (Formerly: Kommunikation und Kybernetik in Einzeldarstellungen).

Continuing the Conversation; a newsletter of ideas in cybernetics. Quarterly. American Society for Cybernetics, C/o Department of Decision Sciences, George Mason University, Fairfax, VA 22030.

Cybernetic Journal of the American Society of Cybernetics, Quarterly. Editorial Office: Paul Trachtman, editor, (202) 357-1612. Smithsonian Magazine; 900 Jefferson Place, Washington, DC 20560.

Cybernetic Problems in Bionics. H. Oestreicher, Ed. London: Gordon and Breach; 1968.

Cybernetica. Journal de L'Association International de Cybernetique, quarterly; text in English and French. Editorial Office: M. Andre Nelis, editor; Palais des Expositions; Place Andre Rijckmans; Namur B-5000 BELGIUM.

Cybernetics, English translation of **Kibernetica.** Journal of the Akademiya Nauk Ukrainskoi S.S.R., UR. Bi-monthly. Consultants Bureau (Subsidiary of Plenum Publishing Corp.) 233 Spring St., New York, NY 10013.

Cybernetics Abstracts. English transl. of **Referativnyi Zhurnal-Kibernetika**. Monthly. Scientific Information Consultants Ltd., 661 Finchley Rd., London NW2 2HN, England.

Cybernetics and the Management of Large Systems. Proceedings of the Second Annual symposium of the American Society of Cybernetics. E. Dewan, Ed. New York: Spartan Books; 1969.

Cybernetics and Systems. Journal of the Austrian Society for Cybernetic Studies; Österreichische Studiengesellschaft für Kybernetik, bi-monthly. Editorial Office: Robert Trappl, editor; University of Vienna; Department of Medical Cybernetics & Artificial Intelligence; Freyung 6; Vienna A-1010 AUSTRIA. Business Office: Hemisphere Publ. Corp.; 1010 Vermont Avenue, NW; Washington, DC 20005 USA.

Cybernetics: Works in Progress. irregular. Intern. Association for Cybernetics; Palais des Expositions; Place Andre Rijckmans; Namur B-5000 BELGIUM.

General Survey of Systems Methodolgy: Proceedings of the 1982 Annual Meeting, Society for General Systems Research. L. Troncale, Ed. Louisville: Systems Science Institute; 1982.

General Systems Bulletin. Weekly newsletter of the International Society for the Systems Sciences. International Society for the Systems Sciences; Institute of Safety and Systems Management; University Park, MC-0021; Los Angeles, CA 90089.

General Systems Yearbook. Yearbook of the International Society for the Systems Sciences, annual. William Reckmeyer, editor; San Jose State Univ.; San Jose, CA 95192-0113, USA. International Society for the Systems Sciences; Institute of Safety and Systems Management; University Park, MC-0021; Los Angeles, CA 90089.

Grundlagenstudien Aus Kybernetik und Geisteswissenschaft. Humankybernetik. Institut fur Kybernetik. (Supplement available) 4 per year. Ed. D. Helmar Frank. Verlag Modernes Lernen, P.O.B. 748, Hohe Str. 39; D-4600 Dortmund 1, W. Germany.

International Congress for Cybernetics. Proceedings. Namur Belgium: International Association for Cybernetics; 1956-: triennial.

International Cybernetics Newsletter.

International Institute for Applied Systems Analysis (Laxenberg, Austria), **Working Papers**, and other publications**.**

International Journal of General Systems. Editorial Office: George Klir, editor; SUNY Binghamton; Binghamton, NY. Business Office: Gordon & Breach Science Publishers.

International Journal of Systems Research: see **Systems Research.**

Journal of Applied Systems Analysis. University of Lancaster, UK.

Journal of Cybernetics. Transactions of the American Society for Cybernetics (continued by **Cybernetics and Systems**). Washington, DC: Hemisphere Publishing; 1971-June 1980: quarterly.

Kybernetes. International Journal of Cybernetics and General Systems, quarterly. Editorial Office: John Rose, editor; 5 Margate Road; St. Annes-on-Sea, Lancastershire; England FY8 3EG, UK. Business Office: Thales Publications (WO) Ltd.; 5 Margate Road; St. Annes-on-Sea, Lancastershire; England FY8 3EG, UK.

Kybernetik. (continued by **Biological Cybernetics**). H. B. Barlow, Ed. Berlin: Springer-Verlag; 1961-1974.

Man in Systems. Papers of the Annual Meeting of the Society for General Systems Research. December 26-30, 1968. New York: Gordon and Reach; 1971.

Modern Trends in Cybernetics and Systems. Proceedings of the Third International Congress of Cybernetics and Systems. Bucharest, Rumania, August 25-29, 1975. J. Rose, Ed. Berlin: World Organization of General Systems and Cybernetics; 1977, 3 vols. Distributed by Springer-Verlag.

Nature and System.

Network. Interscience Publishers

North-Holland Series in General Systems Research. Irregular. Elsevier Science Publishers B. V., Box 211, 1000 AE Amsterdam, Netherlands.

Problems of Cybernetics. Pergamon Press

Progress in Cybernetics and Systems Research. Papers presented at the Symposia organized by the Austrian Society for Cybernetic Studies in cooperation with the Society for General Systems Research and the International Association for Cybernetics.

Progress of Cybernetics. Proceedings of the First International Congress of Cybernetics, London 1969. J. Rose, Ed. London and New York: Gordon and Breach; 1970.

Purposive Systems. Proceedings of the First Annual Symposium of the American Society of Cybernetics. Heinz von Foerster et al, Eds. New York: Spartan Books; 1969.

Revue Internationale de Systematique. Journal of the Association Francaise pour la Cybernetique Economique et Technique. Editorial Office: Bernard Paulré, editor; AFCET; 156 Boulevard Pereire; Paris, F-75017, FRANCE. Business Office: CDR; Central des Revues; 11 rue Gossin; Montrouge Cedex, 92543, FRANCE.

Soviet Cybernetics Review. W. B. Holland, Ed. Santa Monica, CA: Rand Corp.: 1971-: bimonthly.

System Dynamics Review. Journal of the System Dynamics Society, semi-annual. Editorial Office: Eric Wolstenholme, editor; Univ. of Bradford Management Center; Bradford, West Yorkshire; England BD9 4JL, UK. Business Office: System Dynamics Society; Massachusetts Institute of Technology; E40-294; Cambridge, MA 02139, USA.

Systems Practice. Editorial Office: Robert Flood, editor; Department of Systems Science, City University; Northampton Square, London; England EC1V OHB UK. Business Office: Plenum Publishing Company.

Systems Research. Journal of the International Federation for Systems Research. Editorial Office: John Warfield, editor; Insititute for Information Technology; George Mason University; Fairfax, VA 22030 USA. Business Office: Pergamon Press, Maxwell House; Fairview Park; Elmsford, NY 10523 USA.

Systems Research Yearbook. USSR Institute for Systems Studies, Moscow: Nauka Press.

Systems Science. (Text in English; summaries in Polish and Russian). 1975, quarterly. Editor: Zdzislaw Bubnicki. Politechnika Wroclawska, Wybrzizi Wyspianskiego 27 55250-370 Wroclaw, Poland. (Distr. by: Wissenschaftliche Verbandbuchhandlung Harry Munchberg, Postfach, 1194 Langelscheim 2, FRG.)

Systems Theory Research. English translation of **Problemy Kibernetiki**. A. A. Lyapunov, Ed. New York: Consultants Bureau; 1968-1973 (ceased publication). Supercedes **Problems of Cybernetic**s, issued by Pergamon Press.

B. Natural Sciences

Research findings in chemical and biological self-organization, non-equilibrium systems, nonlinear systems, chaos and strange attractors, macrostructures, theoretical biology, systems ecology, plus comprehensive periodicals in the sciences.

Advances in Chemical Physics. 1958. Irregular. Editor: Ilya Prigogine. John Wiley and Sons, Inc., 605 Third Ave., New York, NY 10016.

Advances in Biophysics. (Text in English). 1968. Annual. Editor: Masao Kotani. (Biophysical Society of Japan, JA). Elsevier Scientific Publishers Ireland Ltd., P.O. Box 85, Limerick, Ireland. (Co-publisher: Japan Scientific Societies Press).

Annual Review of Biophysics and Biophysical Chemistry. 1972. Annual. Editor: Donald M. Engelman. Annual Review Inc., 4139 El Camino Way, Box 10139, Palo Alto, CA 94306-0897.

Annual Review of Biophysics and Bioengineering, see: **Annual Review of Biophysics and Biophysical Chemistry.**

Biophysical Chemistry; an international journal devoted to the physical chemistry of biological phenomena. 1974. 9 per year. Elsevier Science Publishers B.V., Box 211 Amsterdam, Netherlands.

Biophysical Journal. 1960. Monthly. Editor: Eugene Ackerman. (includes Biophsical Society Abstracts) (Biophysical Society) Rockefeller University Press, 1230 York Ave., New York, NY 10021-6399. (Subscr. to Box 5108, Church Street Sta., New York, NY 10249).

Biophysics. English transl. of **Biofizika**. 1957. Bi-monthly. Pergamon Press, Inc., Journals Division, Maxwell House, Fairview Park, Elmsford, NY 10523. (And Headington Hill Hall, Oxford OX3 OBW).

Biomathematics. (Text in English). 1970. Irregular. Springer-Verlag, 175 Fifth Ave., New York, NY 10010. (Also: Berlin, Heidelberg, Tokyo, and Vienna).

Biosystems. 1967. Quarterly. Editor: A. W. Schwartz. Elsevier Scientific Publishers Ireland Ltd., P.O. Box 85, Limerick, Ireland.

Bulletin of Mathematical Biophysics; see: **Bulletin Of Mathematical Biology.**

Bulletin of Mathematical Biology. 1939. Bi-monthly. Editor: Dr. Lee A. Segal. Pergamon Press, Inc., Journals Division, Maxwell House, Fairview Park, Elmsford, NY 10523. (And Headington Hill Hall, Oxford OX3 0BW).

Complex Systems. Complex Systems Publications, Inc. P.O. Box 6149, Champaign, IL 61821-8149. Steven Wolfram, editor.

Current Topics in Developmental Biology. 1966. Irregular. Editor: A. A. Moscona. Academic Press, Inc., 1250 Sixth Ave., San Diego, CA 92101.

Developmental Biology. 1959. Monthly. Editor: Peter J. Bryant. Academic Press, Inc., Journal Division, 1250 Sixth Ave., San Diego, CA 92101.

Ecological Modeling. An international journal on ecological modelling and engineering and systems ecology. 16 per year. Ed. S. E. Joergensen. Elsevier Science Publishers B.V., Box 211, 1000 AE Amsterdam, Netherlands.

European Journal of Biochemistry. (Text in Englsih, French and German). 1967. (Federation of European Biochemical Societies, NE). Springer-Verlag, 175 Fifth Ave., New York, NY 10010. (Also: Berlin, Heidelberg, Tokyo, and Vienna).

Journal of the Atmospheric Sciences. Semi-monthly. Editors: Dr. Richard H. Johnson, Dr. Wayne H. Schubert. American Meterological Society, 45 Beacon St., Boston, MA 02108.

Journal of Chaos and Graphics. Irregular**.** Clifford A Pickover, editor. Subscriptions free! from: Clifford Pickover, IBM Thomas J. Watson Research Center, Yorktown Heights, NJ 10598.

Journal of Chemical Physics. 1931. Semi-monthly. Editor: J. C. Light. American Institute of Physics, 335 E. 45th St., New York, NY 10017.

Journal of Computational Physics. 1966. Monthly. Editor: Berni J. Alder. Academic Press, Inc., Journal Division, 1250 Sixth Ave., San Diego, CA 92101.

Journal of Non-equilibruim Thermodynamics. (Text in English). 1976. 4 per year. Walter de Gruyter und Co., Genthiner Str. 13, 1000 Berlin 30, W. Germany. (U.S. address: Walter de Gruyter, Inc., 200 Saw Mill Rd., Hawthorne, NY 10532).

Journal of Physical Chemistry. 1896. Fortnight. Editor: Dr. Mostafa El-Sayed. American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Journal of Statistical Physics. 1969. 24 per year. Editor: Joel L. Lebowitz. Plenum Press, 233 Spring St., New York: NY 10013.

Journal of Theoretical Biology. (text in English, French, German). 1961. Eds., S. Kauffman, and L. Wolpert. Academic Press Ltd., 24-28 Oval Rd., London, NW1 England.

Mathematical Biosciences; an international journal. 1967. 10 per year. Editor: John J. Jacquez. Elsevier Science Publishing Co., Inc., 52 Vanderbilt Ave., New York, NY 10017.

Nature. International weekly journal of science. Weekly. Editor: John Maddox. Macmillian Journlas Ltd., (Subsidiary of: Macmillian Publishers Ltd.) 4 Little Essex St., London Wc2R 3LF, England. (in USA subscr. to: Nature, 65 Bleecker St., New York, NY 10012).

Naturwissenschaften. Monthly. Editors: H. J. Autrum, F. L. Boschke. (Max-Planck-Gesellschaft zur Foerderung der Wissenschaften, GW) Springer-Verlag, 175 Fifth Ave., New York, NY 10010. (Also Berlin, Heidelberg, Tokyo, and Vienna).

Nonlinear Science: Theory and Applications, irregular. Editor: A. V. Holden. Businesss Office: Manchester University Press, Oxoford Rd., Manchester M13 9PL, England.

Physica; Europhysics Journal. (Consists of Physica A, B, C and D) (Text in English, French and German). 27 per year. Editor: Prof. Dr. J. Van Den Handel. Elsevier Science Publishers B.V., Box 211, 1000 AE Amsterdam, Netherlands.

Physical Review. (General Physics) Monthly. Editor: B. Bederson. (American Physical Society). American Institute of Physics, 335 E. 45th St., New York, NY 10017.

Physical Review Letters. Weekly. (American Physical Society). American Institute of Physics, 335 E. 45th St., New York, NY 10017.

Progress in Theoretical Biology. 1967-1981. Irregular. Academic Press Inc., 1250 Sixth Ave., San Diego, CA 92101.

Scientific American. Monthly. Scientific American, Inc., 415 madison Avenue, New York, NY 10017.

Science. Weekly journal of the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005.

C. Cognitive, Social, Health Sciences

Research findings in cognitive science, human systems and sociocultural self-organization, family therapy, counselling, management science, economic systems, education and educational technology, and philosophy.

American Anthropologist. Quarterly. Editor: H. Russell Bernard. American Anthropological Association, 1703 New Hampshire Ave. NW, Washington, DC 20009.

American Journal of Family Therapy. Quarterly. Brunner-Mazel, Inc., 19 Union Square W., New York, NY 10003. Former titles (until 1979) International Journal of Family Counseling; (until 1976) Journal of Family Counseling.

American Psychologist. Monthly. Editor: Susan Knapp. American Psychological Association, 1200 17th St., NW, Washington, DC 20036.

Behavioral and Brain Sciences; an international journal of current research and theory with open peer commentary. Quarterly. Editor: Steven Harnad. Cambridge Univ. Press, Edinburgh Bldg., Shaftesbury Rd., Cambridge CB2 2RU.

Behavioral Neuroscience. Bi-monthly. Editor: Richard F. Thompson. American Psychological Association, 1200 17th St., NW, Washington, DC 20036.

Brain and Cognition. Bi-monthly. Editor: Harry A. Whitaker. Academic Press, Inc., Journal Division, 1250 Sixth Ave., San Diego, CA 92101.

Brain and Language. Bi-monthly. Editor: Harry A. Whitaker. Academic Press, Inc., Journal Division, 1250 Sixth Ave., San Diego, CA 92101.

British Journal of Psychology. Four per year. Editor: D. E. Blackman. British Psychological Society, St. Andrews House, 48 Princess Rd. E., Leicester LE1 7DR, England.

Cognition; an international journal of cognitive psychology. (Text in English; summaries in French). Nine per year. Editor: Jacques Mehler. Elsevier Sequoia SA, P.O. Box 296, 1001 Lausanne, Switzerland.

Cognitive Neuropsychology. Quarterly. Editor: Max Coltheart. Lawrence Erlbaum Associates, Ltd., 27 Palmeira Mansions, Church Rd., Hove, E. Sussex BN3 2FA, England.

Cognitive Psychology. Quarterly. Editor: Stephen E. Palmer. Academic Press, Inc., Journal Division, 1250 Sixth Ave., San Diego, CA 92101.

Cognitive Science; a multidisciplinary journal of artificial intelligence, psychology, and language. Quarterly. Ablex Publishing Corporation, 355 Chestnut St., Norwood, NJ 07648.

Cognitive Systems. Quarterly. Editor: G. J. Dalenoort. European Society for the Study of Cognitive Systems, c/o Institute for Experimental Psychology, University of Groningen, P.O. Box 14, 9750 AA Haren, Netherlands.

Delfin. A German journal for construction, analysis, and critics. Published by Gebhard Rusch and Siegfried Schmidt. Business Office: Poiesis Verlag; Postfach 2104; D-4840 Rheda-Wiesenbrück; FR-GERMANY

Human Systems Management. Editorial Office: Milan Zeleny, Fordham Univ., Lincoln Center; GBA 626E; New York, NY 10023, USA. Business Office: Elsevier Science Publishers; Journals Department; New York, NY; tel. (212) 916-1250.

International Journal of Family Counseling: see **American Journal of Family Therapy.**

Journal for the Integrated Study of Artificial Intelligence, Cognitive Science, and Applied Epistemology.

Journal for the Theory of Social Behavior. Four per year. Editor: Charles W. Smith. Basil Blackwell Ltd., 108 Cowley Rd., Oxford OX4 1JF, England.

Journal of College Student Personnel: see **Journal of College Student Development.**

Journal of College Student Development. 6 per year. American College Personnel Association. Editor: Robert D. Brown. American Association for Counseling and Development, 5999 Stevenson Ave., Alexandria, VA 22304.

Journal of Experimental Psychology: Learning, Memory, and Cognition. Quarterly. Editor: Henry L. Roediger. American Psychological Association, 1200 17th St., N.W., Washington, DC 20036.

Journal of Family Therapy. Quarterly. Editor: Dr. B. Lask. Academic Press Ltd. (London), 24-28 Oval Rd., London NW1 7DX, England.

Journal of the History of the Behavioral Sciences.

Journal of Marital and Family Therapy. Quarterly. Editor: Alan Gurman. American Association for Marriage and Family Therapy, 1717 K St. NW, No. 407, Washington, DC 20006.

Journal of Marriage and the Family. Quarterly. Editor: Alan Booth. National Council on Family Relations, 1910 W. County Rd. B, Ste. 147, St. Paul, MN 55113.

Journal of Neurophysiology. Monthly. Editor: Lorne Mendell. American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814.

Journal of Neuroscience. Monthly. Editor: W. Maxwell Cowan. Soceity for Neuroscience. Oxford University Press, Journals, 200 Madison Ave., New York, NY 10016.

Journal of Social and Biological Sturctures. Quarterly. Editors: H. Wheeler, Robert Rosen. Academic Press Ltd., (London), 24-28 Oval Rd., London NW1 7DX, England.

Journal of Systems Management.

Journal of Systems Therapy (See: Zeitschrift für systemische Therapie.)

Management Science. Monthly. Editor: David Morrison. Institute of Management Science, 290 Westminster St., Providence, RI 02903.

Perception and Psychophysics. Monthly. Editor: Charles W. Eriksen. Psychonomic Society, Inc., 1710 Fortview Rd., Austin, TX 78704.

Philosophy of Science. Quarterly. Editor: Robert Butts. Philosophy of Science Association, 18 Morrill Hall, Dept. of Philosophy, Michigan State Univ., East Lansing, MI 48824.

Progress in Psychobiological and Physiological Psychology. Irregular. Editor: Alan N. Epstein. Academic Press, Inc., Journal Division, 1250 Sixth Ave., San Diego, CA 92101.

Psychological Review. Quarterly. Editor: Martin L. Hoffman. American Psychological Association, 1200 17th St., N.W., Washington, DC 20036.

Semiotica. (Text mainly in English and French; occasionally in German and Russian). ten per year. (International Association for Semiotic Studies). Walter de Gruyter & Co., Mouton Publishers, Postfach 110240, D-1000 Derlin 11, W. Germany.

Theory and Decision: an international journal for philosophy and methodology of the social sciences. 6 per year. Editor: W. Leinfellner. D. Reidel Publishing Co., Box 17, 3300 AA Dordrecht, Netherlands. (Also: 190 Old Derby St.; Hingham, MA 02043, USA).

Zeitschrift für Psychologie.

Zeitschrift für systemische Therapie. Journal of Systemic Therapy. Editorial Office: Jürgen Hargens, editor; Norderweg 14; D-2391 Meyn; FR GERMANY. Business Office: verlag modernes lernen; Hohe Strasse 39; D-4600 39; FR GERMANY.

D. Information and Computer Sciences, Engineering

Research findings in information science, information management, computer science and computation, mathematics, systems analysis, decision, control, and automation, man-machine studies, information theory, robotics, systems engineering, etc.

Artificial Intelligence; an international journal. Nine per year. Editor: D. G. Bobrow. Elsevier Science Publishers, B.V., Box 211, 1000 AE Amsterdam, Netherlands.

Automatic Control - Production Systems. Association Francaise pour la Cybernetique Economique et Technique. Quarterly. (Text in French or English). B. Dubuisson, editor. Centrale des Revues Dunod Gauthiers Villars, 11 rue Gossin, 92543 Montrouge Cedex, France.

Complex Systems.

Control Cibernetica y Automatizacion. Ministerio de la Industria Basica, Instituto de Matematica, Cibernetica, y Computacion. quarterly. (Text in Spanish; summaries in English and French). Academia de Ciencias de Cuba; Centro Nacional de Informacion Cientifico-Tecnica; Capitolio Nacional; Havana 2, Cuba.

Control and Cybernetics. Polska Akademia Nauk, Systems Research Institute. quarterly. (Text in English; summaries in Polish and Russian). Panstwowe Wydawnictwo Naukowe; Ul. Miodowa 10; 00-251 Warsaw, Poland.

Cybernetics and Computing Technology. English translation of: Kibernetika i Vychislitelnaya Tekhnika. Akademiya Nauk S.S.S.R., UR. Quarterly. Allerton Press, Inc., 150 Fifth Qve., New York, NY 10011.

Dynamics and Stability of Systems. 1986. Quarterly. Editor: K. Huseyin. Oxford University Press, Walton St., Oxford OX2 6DP, England.

Engineering Cybernetics, see: **Soviet Journal of Computer and Systems Sciences.**

IBM Systems Journal. C. A. Thiel, Ed. New York: Intenational Business Machines; 1962-: quarterly.

IEEE International Conference on Systems, Man, and Cybernetics; Proceedings. IEEE Systems, Man, and Cybernetics Society; Annual. Institute of Electrical and Electronics Engineers; 345 East 47th Street; New York, NY 10017.

IEEE Transactions on Information Theory. Bi-monthly. Editor: Toby Berger. Institute of Electrical and Electronics Engineers; 345 East 47th Street; New York, NY 10017.

IEEE Transactions on Systems, Man, and Cybernetics. Journal of the IEEE Systems, Man, and Cybernetics Society, publ. monthly. Editorial Office: Andrew S. Page. editor; George Mason University; Fairfax, VA 22030. Business Office: Institute of Electrical and Electronics Engineers; 345 East 47th Street; New York, NY 10017-2394.

Information and Computation. 1958. Monthly. Editor: Albert R. Meyer. Academic Press, Inc., Journal Division, 1250 Sixth Ave., San Diego, CA 92101.

Information and Control. see: **Information and Computation.**

Information and Management: systems, objectives, solutions. International Federation for Information Processing, Applied Information Processing Group. 10 per year. Editor: E. H. Sibley. Elsevier Science Publishers B. V., Box 211, Amsterdam, Netherlands.

Information and Systems Theory. New York: Gordon and Breach; 1969-.

Information Sciences. an international journal. 9 per year. Ed. Paul Wang. Elsevier Science Publishing Co., Inc., 52 Vanderbuilt Ave., New York, NY 10017.

International Journal of Man-Machine Studies. Monthly. Editors: B. R. Gaines, D. R. Hill. Academic Press Ltd., (London), 24-28 Oval Rd., London NW1 7DX, England.

International Journal of Systems Science. 1970. Monthly. Editor: Prof. B. Porter. London: Taylor & Francis, Ltd; 1970-.

Journal of the American Society for Information Science. Bi-monthly. Editor: Charles T. Meadow. John Wiley and Sons, Inc., 605 Third Ave., New York, NY 10158.

Journal of Complexity. Quarterly. Editor: Joseph F. Traub. Academic Press, Inc., Journal Division, 1250 Sixth Ave., San Diego, CA 92101.

Journal of Computer and Systems Sciences. Bi-monthly. Editory: Edward K. Blum. Academic Press, Inc., Journal Division, 1250 Sixth Ave., San Diego, CA 92101.

Journal of Cybernetics and Information Science. North Hollywood, CA: American Society for Cybernetics; 1967-.

Journal of Systems Engineering.

Large Scale Systems: Theory and Applications. (Text in English). Editors: Madan G. Singh, Andrew P. Sage. Elsevier Science Publishers B. V., Box 211, 1000 AE Amsterdam, Netherlands.

Mathematical Systems Theory. Editor: S. A. Greibach. New York: Springer Verlag: 1967-: quarterly.

Nonlinear Analysis: theory, methods, and applications, monthly. Editor: V. Lakshmikantham. Business Office: Pergamon Press, Inc., Journals Division, Maxwell House, Fairview Park, Elmsford, NY 10523.

Problems of Control and Information Theory. Problemy Upravleniya I Teorii Informatsii. (Text and summaries in English and Russian). Bi-monthly. Akademiai Kiado, Publishing House of the Hungarian Academy of Science, P.O. Box 24, H-1363, Budapest, Hungary. (Dist. in Western countries by: Pergamon Press, Mexwell House, Fairview Park, Elmsford, NY 10523 USA).

Revue Internationale de Systematique. Journal of the Association Francaise pour la Cybernetique Economique et Technique. Editorial Office: Robert Valee, editor; AFCET; 156 Boulevard Pereire; Paris, F-75017, FRANCE. Business Office: CDR; Central des Revues; 11 rue Gossin; Montrouge Cedex, 92543, FRANCE.

Soviet Journal of Computer and Systems Sciences. English transl. of: **Tekhnicheskaya Kibernetika**. Bi-monthly. Editors: Robert N. McDonough, Reed K. Even. Scripta Technica, Inc., 7961 Eastern Ave., Silver Spring, MD 20910.

Systems, Objectives, Solutions: see **Information and Management.**

6. Publications: Books

DESCRIPTION: here is a small sample of the vast literature already published in the sciences of complexity. This listing represents literature of several areas of systems thinking and represents some of the recent theoretical developments in the sciences. Suggested in bold type are **several non-technical introductory books** to systems thinking and complex dynamical systems which can provide an overall idea of the emerging systems view of the world.

There also exist several book series in systems science fields; the Springer Series in Synergetics (Springer Verlag), the Series in General Systems Research (Elsevier Science Publishing Co.), and the Systems Science and World Order Library (Pergamon Press) are among a few. Also INTERSYSTEMS Publications specializes in books on systems thinking, both reprints as well as new issues. The current catalog is obtainable from: 401 Victor Way No. 3, Salinas, CA 93907, USA.

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[*] Books in bold type are suggested non-technical introductory books to systems thinking and the sciences of complexity.

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Life Sciences Collection. Cambridge Scientific Abstracts. Consists of national and international journals, books, conference proceedings and reports on animal behavior, biochemistry, ecology, endocrinology, entomology, genetics, immunology, microbiology, oncology, neuroscience, toxicology, and virology.

Keyword and Word Cluster Index

Listed here are the some of the more important keywords used in preparation for this guide.

Central Keywords
autopoiesis
chaos
chaotic
cognitive systems
complex systems
complex dynamical systems
complexity
cybernetics
dissipative structures
dynamical systems
fractals
general systems
nonequilibruim
nonlinear
self-adapting
self-organization
self-organizing
self-regulating
strange attractor
synergetics
systems analysis
systems approach
systems research
systems science
systems theory
systems view

Other Keywords
adaptive systems;
artificial intelligence;
artificial life;
attractor;
    fixed point attractor,
    quasi-periodic attractor,
    strange attractor,
autopoiesis, autopoietic;
    autopoetic systems,
    autopoetic systems theory,
bifurcation;
    bifurcation point,
    bifurcation theory,
bionics;
catastrophe theory;
cellular automata;
chaos, chaotic;
    chaotic systems,
    chaos theory,
cognition, cognitive;
    cognitive science,
    cognitive system,
connectionist, connectionism;
communication;
    communication systems,
    communication theory,
complex, complexity;
    complex systems,
    complex systems research,
    complex systems theory,
cybernetics;
    cybernetic systems,
    biocybernetics,
    sociocybernetics,
dynamics, dynamical;
    dynamical systems,
    dynamical systems research,
    dynamical systems theory,
dissipative;
    dissipative self organization,
    dissipative structures,
    dissipative systems,
ecological, ecology;
evolving systems;
emergence, emergent;
    emergent properties,
entropy;
family therapy;
fractal;
    fractal boundaries,
    fractal dimensions,
    fractal geometry,
    fractal sets
general systems;
    general systems research,
    general systems theory,
holistic, holism;
information;
    information systems,
    information theory,
interdisciplinary;
irreversible, irreversibility;
    irreversible process,
learning systems;
limit cycle;
living systems simulation;
macro-;
    dynamics,
    scope,
    structures,
management;
    science,
    systems,
neural networks;
non-equilibrium;

systems,
thermodynamics,
nonlinear, nonlinearity;
nonlinear science,
nonlinear systems,
operations research;
order through fluctuation;
parallel distributive processing, PDP;
process;
process philosophy,
process structure,
self-organization, self-organizing;
self-organizing systems,
self-adapating systems;
self-referential systems;
self-similarity;
semiotics;
strange attractors;
structuralism, structuralist;
synergetics;
synergetic systems,
systems;
approach,
analysis,
design,
ecology,
engineering,
epistemology,
perspective,
philosophy,
research,
science,
theory,
therapy,
view,
theoretical biology;
turbulence, turbulent;
research
theory
wholeness;

Name Index

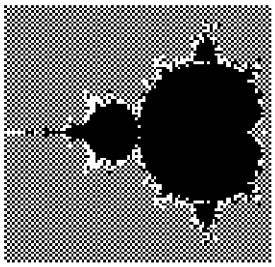
Arranged here alphabetically by name are all entries in the following sections of the guide: Section 1 on Institutions that offer degree-granting programs in systems science; Section 2 on Research Centers and Institutes; and Section 3 on Societies and Associations.

About The Elmwood Institute:

The Elmwood Institute was founded by physicist Fritjof Capra to facilitate the cultural shift from a mechanistic and partiarchal world view to a holistic and ecological view. Its purpose is to nurture new ecological visions—based on awareness of the fundamental interdependence of all phenomena and of the embeddedness of individuals and societies in the cyclical processes of nature—and to apply these visions to the solution of current social, economic, environmental, and political problems.

Elmwood's programs include **Global File**, the collection and evaluation (from a systemic perspective) of ecological success stories in business and government.

For more information on Global File or other Elmwood programs and events, call (415) 845-4595, or write: P.O. Box 5805, Berkeley, CA 94705.



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Information and Consulting Services

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Olympia, WA 98502 Phone: (206) 866-8526

About Systems Education Research:

Systems Education Research is a private research project established to collect, manage, and present information on education and research activities in the sciences of complexity or systems sciences. Its primary objective is to bring together the multiple manifestations of the study of complex systems, regardless of their relation to traditional disciplines, in order to make these studies more accessible to students, educators, career counselors, and professionals interested in the field.

The project aims are 1) to improve awareness of complexity studies and systems science, and 2) to improve understanding of the systemic nature of our world.

The project has been conducted by Blaine A. Snow and is at present under the direction of cybernetics veteran Heinz von Foerster. Consultants for the project have included: 1. Fritjof Capra, The Elmwood Institute; 2. Heinz von Foerster, Emeritus, Univ. of Illinois; 3. Lenard Troncale, Intern. Society for the Systems Sciences; 4. Martin Zwick, Portland State University, Systems Science Ph.D. Program; and 5. Michael Simmons, Santa Fe Institute.

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Blaine A. Snow holds a Bachelor of Arts degree from the Evergreen State College in Olympia Washington with an emphasis in the history and philosophy of science. His main areas of interest are systems epistemology and the philosophy of mind.

At present Mr. Snow is occupied with research in systems science education and directs the Systems Education Research project out of his home.