Nursing, Caring, and Complexity Science:

For Human–Environment Well-Being
Alice Ware Davidson, RN, PhD, was one of the first nurses to study and research the relationship between the Rogerian science of unitary human beings and complexity science in a complex technological environment. She devoted her academic life to researching complexity sciences, complex health care systems, nursing, and health care. Throughout her career, Dr. Davidson advanced complexity sciences in nursing theory, research, administration, and clinical practice. Dr. Davidson received her doctor of philosophy degree from the University of Colorado College of Nursing, Aurora, Colorado. She completed postdoctoral studies at Harvard University, studied at the Santa Fe Institute in New Mexico, and the New England Center for Complex Systems in Boston, Massachusetts. In 2005, Dr. Davidson studied with the renowned complexity scientist, Dr. F. David Peat, in Pari, Italy. Dr. Davidson was an assistant clinical professor at the University of Colorado, College of Nursing, where she taught nursing theory, research, and supervised students in clinical nursing practice. In December 2009, Dr. Davidson lost her battle with cancer. This book is dedicated to Dr. Davidson. Her legacy lives on through the scholarship on complexity sciences, nursing, and caring presented in this book.

Marilyn A. Ray, RN, PhD, CTN-A, Professor Emeritus, Florida Atlantic University, is a renowned nursing educator and researcher of caring in complex health care systems and transcultural nursing. She was a colleague and good friend of Dr. Alice W. Davidson and worked with her on articles related to complexity sciences and nursing. Dr. Ray is an advanced transcultural nurse committed to the development and progress of transcultural caring in nursing worldwide. She is well known for her theory of bureaucratic caring, which integrates knowledge of human caring within complex technological, economic, legal, and political systems in hospital organizations. Previous awards include the Christine E. Lynn Eminent Scholar Chair in Nursing, Florida Atlantic University; Yingling Visiting Scholar, Virginia Commonwealth University; Visiting Lecturer, University of Alberta, Canada, Clinical Sciences Division. Ray attended seminars at the Kennedy Institute of Ethics, Georgetown University. She also studied with Dr. F. David Peat in Pari, Italy, the distinguished physicist in the sciences of complexity. Other fellowships include the Ministry of Health of Ontario and visiting scholar positions in universities in Australia. She has held faculty positions at the University of Colorado, College of Nursing; the Union Institute, Cincinnati; McMaster University, Hamilton, Canada; the University of California, School of Nursing; and the University of San Francisco, School of Nursing. From 1967 to 1999, Dr. Ray served as an officer in the United States Air Force, beginning first with the Wyoming Air National Guard followed by the United States Air Force Reserve. She held the rank of Colonel from 1984 to her retirement in 1999. During her military career, Ray held many diverse positions—flight nurse, educator, researcher, and administrator in many USAF Commands across the United States. She attended the Marshall Space Center to support the potential role of nursing in space. During the last 8 years of her career she was a researcher at the USAF School of Aerospace Medicine, Brooks Air Force Base, Texas. Ray recently completed a book titled Transcultural Caring Dynamics in Nursing and Health Care. She edited one book with Dr. Jean Watson and has numerous chapters and peer-reviewed articles in many journals. Her work is translated into different languages. She has over 20 funded research grants totaling almost one million dollars, and presents nationally and internationally, the most recent at the World Universities Forum in Davos, and universities in Lausanne, Switzerland. Ray recently visited the WHO, and the International Council of Nurses in Geneva, Switzerland, sharing knowledge and her experience of transcultural nursing, theory and research, and a vision for the future of nursing within the complex global environment.
Marian C. Turkel, RN, PhD, NEA-BC, is the Director of Professional Nursing Practice at Albert Einstein Healthcare Network (AEHN) and is on the faculty of the Watson Caring Science Institute (WCSI). In her role at AEHN she is responsible for advancing Watson’s theory of human caring, integrating research and evidence-based practice initiatives, creating a professional practice environment, and focusing on tenets from complexity science related to innovation and organizational transformation. As part of the faculty of the WCSI, Dr. Turkel works with various hospitals on the practical application of the theory and does presentations on caring science with an emphasis on education, leadership, practice, and research. Her commitment to advancing caring science and valuing caring being the essence of nursing practice started in 1989 when she returned to school for a master's in nursing administration at Florida Atlantic University (FAU). After graduation, Dr. Turkel enrolled in the University of Miami’s PhD program and in 1997 she returned to FAU as an assistant professor and taught undergraduate and graduate theory, research, and leadership courses. In 2002 she relocated to Chicago and began consulting with various hospitals on developing practice innovations related to Magnet, creating research initiatives, implementing Watson’s theory of human caring into the practice setting, and working with leaders to understand the core value of caring in nursing practice. Over the course of her career she has worked in collaboration with Dr. Marilyn Ray and was the coprincipal investigator on almost one million dollars in federal research funding to study the relationship among caring, economics, and patient outcomes. Dr. Turkel authored a textbook on strategies for obtaining Magnet Program Recognition®, published in peer-reviewed journals, contributed chapters in nursing textbooks, and presented at numerous national and international conferences. She has been actively involved with the International Association for Human Caring for approximately 20 years and assumed the role of President Elect in June 2010.
Nursing, Caring, and Complexity Science:

*For Human–Environment Well-Being*

_Alice Ware Davidson, RN, PhD_

_Marilyn A. Ray, RN, PhD, CTN-A_

_Marian C. Turkel, RN, PhD, NEA-BC_
Dedications

The spirit and creativity of this book on complexity science and nursing science first began with the dedication to new knowledge by our colleague and friend, the late Dr. Alice W. Davidson. Over the past 25 years, Alice encouraged me to pursue the new science and reflect on and study how the new cosmology could transform nursing. In conjunction with the philosophy and science of caring, the science of unitary human beings, transcultural nursing, and the study of complexity sciences, I have begun my journey to understand the meaning of how we, as nurses and professors, cocreate the reality we desire from the spiritual–ethical choices we make. This new consciousness of the integration of mind, spirit, and caring energy illuminates the significance of the mutual human–environment caring relationship, our unitary interconnectedness. Through this vision, and the love and support of my late husband, Jim, and friend Alice, my family, my colleagues, and friends, especially my friends and co-editor, Dr. Marian Turkel and husband, Brooks, I am committed to continue the effort for clarity of understanding the dynamic and complex caring relationship, and how the world can be transformed by caring intention, will, knowledge, and practical wisdom.

Marilyn A. (Dee) Ray

This book is dedicated to my mentors and guides on my journey to understanding the scholarship of caring science. Dr. Carolyn Brown, Dr. Anne Boykin, Dr. Marilyn Parker, Dr. Marilyn Ray, Dr. Savina Schoenhofer, and Dr. Jean Watson provided ongoing love, nurturance, and support, and inspired me to think differently, conduct research, and publish. A special thanks to my co-editor Dr. Marilyn Ray for believing in me so many years ago and inviting me to become a part of her research and scholarship. To the faculty and Board of Directors of the Watson Caring Science Institute, I am honored to be on the journey with all of you and consider each and everyone a special friend and caring colleague. A special dedication to my family, friends, and professional colleagues who understood why I have not been sending cards or e-mails as much as I have wanted to over the past few months. I would like to dedicate this book to registered nurses in the practice setting who have made the personal and professional commitment to using tenets of caring science and complexity science to inform practice. You are
the change agents. Most important is the special dedication to my husband Brooks Turkel. Brooks is truly my bashert (soul mate in Judaism). His love and caring energy allow my inner creativity to emerge. He honors, respects, and understands my passion for reading, reflecting, and writing. He is always there for me as I explore the scholarship of caring science and make a humble attempt to advance the discipline of nursing and transform practice.

Marian C. Turkel

This book is dedicated to our colleague and friend, Dr. Alice Ware Davidson. Alice died December 2, 2009, after a relatively short battle with malignant melanoma, actually while she was in the process of editing this book with me, Marilyn Dee Ray.

Alice was gifted with a different way of thinking; a scientist, an artist, and a technologist. Alice was one of the first nurse scholars to dedicate her academic life to the study of holistic science and the science of change—complexity sciences. Alice integrated complexity sciences, Rogers’ science of unitary human beings, technology, and their application to nursing, caring, health care, and the deep meaning of healing and well-being within the mutual human–environment process. Not only did Alice achieve a PhD in complexity science and nursing at the University of Colorado College of Nursing under the leadership of the former dean, Dr. Jean Watson, and professor Dr. Marilyn Ray, but also, she continued to further her knowledge of complexity sciences and methodology through the following paths: study and postdoctoral work at Harvard University and the New England Center for Complex Systems with her mentor, Dr. Yaneer Bar-Yam and colleagues; the University of Colorado Complex Systems Department; the Santa Fe Institute; and in Italy with Dr. F. David Peat, a renowned quantum physicist originally from the United Kingdom, former Director of the National Science Foundation of Canada, a colleague of scientists, Drs. David Bohm, Rupert Sheldrake, and John Briggs, and a founder and educator of Holistic Science at the Pari Center for New Learning in Pari, Italy, to further the study of the science and art of change and holism, healing, and well-being. During this time of learning and “quiet action” to understand our mysterious universe and nursing and healing, Alice raised two wonderful children, Anne and John. Both children followed in Alice’s footsteps. Anne works in Idaho as a scientist, caring for the natural environment and the animals of the earth, and John is a chef, preparing nutritious foods in his restaurant for the people of Denver, Colorado. Alice also leaves a legacy of love and caring to her long-time and dedicated partner, John Smith, and her three grandchildren.

When Alice was diagnosed with malignant melanoma, she was conceiving the ideas for this book and seeking out the many scholars to write chapters of their conceptualizations and research of complexity sciences, nursing, and human–environment well-being. Alice would want you to know for
preventive health purposes that the melanoma began with a very tiny mole between her right baby and fourth toes and spread throughout her body from there. Although Alice sought treatment at M. D. Anderson Medical Center in Houston, and other treatments, the cancer progressed. However, the cancer did not stop her marvelous beliefs and creative energy to bring to life the philosophy, scientific theories, and applications to practice that you will experience from reading this book. Alice was a courageous woman, dedicated to her family and her profession. She loved life! She loved to learn about this universe and health and healing. She loved her family and friends. She revered the environment not only to understand it through science but also as an appreciator and protector of it through her commitment to what ought to be in the hearts of all of us, ethical agents or, as Socrates challenged us thousands of years ago, giving thought and action to how we ought to live. Alice’s humility, respect for all people and creatures of the earth, and her sense of reverence for the environment was also lived out in nature at the home she shared on the Pacific Ocean with John. She enjoyed gardening and care for the fauna and flora. At her home, she was committed to preserving the environment in every way so that it can always be balanced and beautiful. Alice felt that each one of us must cultivate love for and have an ethical obligation to protect, preserve, and safeguard all that we as humans have been given. We must think with our hearts and minds, with feeling and reason. Alice stated that choice was the “conductor of the symphony” in the balance and beauty of the human–environment relationship. Let us follow in her footsteps to make the right choices and find meaning and joy in the preservation of the beauty of the Universe in this dance of life.

With gratitude to a loving friend for her gifts to us,

Marilyn A. (Dee) Ray
Marian C. Turkel
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This book asks: “What can science say about the complex task of nursing?” One of the remarkable advances in science in the last few decades is the opportunity to address questions that previously were inaccessible to scientific inquiry. Traditionally, science organized itself around questions that could be answered. Increasingly, we ask the questions we want to answer about the world around us.

I have been privileged to participate in developing and applying new methods of science that can better satisfy our desire to know and understand the world around us. Fifteen years ago, I offered a course at Boston University on the fundamental science of complex systems. Among my students was Professor Alice W. Davidson. Of this mathematical treatment of complex systems theories, Alice demanded insight and application to real-world problems of nursing. In parallel with the course activities, she performed research on the complexity of elderly living environments, eventually publishing a paper that validated the abstract theoretical understanding of complexity in this real-world context (Davidson, Teicher, & Bar-Yam, 1997). Complexity is a real world property, which we all encounter whether we use quantitative definitions or not.

Our ability to successfully engage with the world and our tasks within it depends on a reasonable matching of the complexity of our environments with our own complexity. The importance of this concept has increased as the complexity of our society has increased. Alice’s work has direct implications for the environments of our elderly individuals. Designing them carefully is necessary in order to enable them to be intellectually active and yet not overwhelmed.

This demonstration has much broader implications across all domains of our existence. For this volume, the condition in which the nurse works, the complexity of his or her environment is similarly important to recognize, calibrate, and ensure. As I engaged in this concept and its applications in the 15 years since Alice’s study, I have found the pervasive importance of this insight in the design of our environments, our organizations and those of our children and parents.

Over the years, Alice continued to challenge me to make practical for nursing the formal and quantitative insights of complex systems research.
Alice and her co-editors, Marilyn Ray and Marian Turkel, are pioneers in the insight that it is possible to bring science to address the most complex, personal, interpersonal, biological, and social conditions. Nurses help people under complex stresses, biologically, physically, and socially. Essential to future advances in this field is recognizing this complexity as well as the opportunities we have for deep understanding and insights. This volume illustrates the many opportunities for scientific study.

It is difficult to write this foreword knowing that Alice will not be present in any of my future classes, though her contributions are surely always represented in the slides where I describe her findings.

As the editors and authors clearly state, “nursing is about caring.” It is appropriate that the effort to bring complex systems science into nursing received such early attention. After all, it is complex systems science that provides a framework for thinking about relatedness and relationships, a concept diminished in traditional science. The example I often give of the lack of perspective on relationships and their importance is the traditional dictionary definition of *mother*: “A female parent.” The often-missing relational definition might be “What a child calls his or her female parent.” The difference is both simple and profound, with pervasive significance for our society.

It should be clear that despite abstract concepts and formulations, underlying the effort of this book is a profound sense of relationship with those who need help, those we care for.

_Yaneer Bar-Yam_
New England Complex Systems Institute

**REFERENCE**

The is a long overdue work by visionary scholars in complexity science: Dr. Alice W. Davidson (who sadly left this earth plane as this manuscript was being completed) and her beloved gifted colleagues, Dr. Marilyn (Dee) Ray and Dr. Marian Turkel, who serve as editors of a comprehensive project with outstandingly diverse nursing, physician, science, and administrator authors. This contemporary and futuristic publication offers a special gift by integrating nursing science, caring science, unitary, and complexity science into a new whole, helping to uncover the effects of caring on nursing, complexity, and human environments. This work intersects with personal/professional practice, education, research, administration, and health care systems at all levels.

It is an honor and privilege to endorse this critical work at this point in time. The developments and focus in this publication also pass the test of time. It brings us into a new era of human consciousness and the role and relevance of complexities and dynamics of human caring–healing environments in which we live and work and find our being and becoming as persons and as human systems.

This collected, edited manuscript is a magnificent exemplar of the evolving work in caring science. It is a unique honor to have this work included in the Watson Caring Science Institute Library at Springer Publishing Company.

The focus of this scholarship brings new meaning and depth of complexity science to caring science, to healing relationships and human healing systems. It brings entirely new dimensions to the phenomenon and overused mind-set of “quality.”

When one falls into the depth of the scholarship in this emerging field, one is drawn into the ethic, the philosophical grounding of an emerging worldview, a cosmology that unites, connects, explains, and helps to order our very reality, our chaotic world. It offers a passionate new order of human evolution that embraces the paradox, the chaotic, the disorder, offering a new lens to understand, to comprehend, to personalize, to professionalize, and to give scientific and wisdom insights into creative emergence for what might be called Ontological Development or Ontological Design programs, projects and purposeful transformative practices that inform and authenticate human existence, human caring, and healing at the human relationship and environmental level.
This manuscript combines an array of authors’ talents and perspectives in this growing field. Each chapter includes a scholarly response to further inform the ontological and epistemological underpinnings of this dynamic science, integrating the science of unitary human beings, complex caring and human inquiry, and the complexity of the dynamics of human caring. The multiple authors bring together and unify deep dimensions, which invite personal and professional reflective scholarship and philosophical and theoretical integration that is combined into a new synthesis of understanding for nursing and health care.

These diverse chapters and the multiple authors’ foci help one to grasp the relevance as well as the ironic complexity of disease, illness, and caring systems as well as treatment approaches projecting the reader into technological, electronic documentation, and the future of humanoid relationships in nursing and complexity science(s).

Such a comprehensive collection of work in the field of a unitary model of complexity is a testimony to the importance of this work and how it both grounds and transcends conventional views of science and reality and opens up new horizons of unitary visions. This collected scholarship in this area will inform the personal/professional evolution of caring and nursing in this century and beyond, inviting new visions of the evolved human in the world of practice, education, research, administration, and clinical care. It is truly a visionary futuristic manifesto for this time in nursing and health sciences at all levels.

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Nursing’s disciplinary focus is the relationship of caring within a mutual human–environment health experience for healing and well-being (Newman, Sime, & Corcorran-Perry, 1991; Newman, Smith, Pharris, & Jones, 2008; Ray, 2010a, 2010b; Ray & Turkel, 2010; Turkel, Ray, & Kornblatt, in press; Watson, 2005, 2008). With over 150 years of caring science and concentrated research over the past 30 years in the scholarship of caring, we have much to build on. As such, two central perspectives are highlighted in this book: Nightingale’s (1859/1969, 1992, 2010b) conceptual system along with Watson (1985, 2005, 2008) and Ray’s (1981a, 1984, 1989, 2001, 2006, 2010b) caring theories. Also described is a comparison of the caring theories, the science of unitary human beings (SUHB), and the philosophy of complexity sciences. Such views on caring, the SUHB, and complexity depict a new form of trans-theoretical convergence—with each philosophy, theory of nursing, and sciences of complexity considering the mutual processes of human–environment interaction. In nursing, of course, it was Nightingale (1859/1969) who first identified this perspective.

This prologue thus underscores Nightingale’s (1859/1969, 1992) theory of nursing as a reparative process that facilitates knowledge of the integrity of the human–environment relationship. The SUHB of Rogers (1970, 1990), emphasizing the continuous and emergent nature of the simultaneous human and environmental fields at any given point in space and time, is illuminated. Although there are a number of caring theories, for the purposes of this prologue, the caring sciences of Watson and Ray will be highlighted.

Indeed, Watson’s (1985, 2005, 2008) transpersonal theory of caring, which centers on caring as a moral ideal, love, and harmony of body, mind, and spirit, is emphasized. Equally so is Ray’s theory of bureaucratic caring (1981a, 1984, 1989, 2006, 2010b) (Coffman, 2010; Ray & Turkel, 2010; Turkel, 2007), which describes caring as the relationship between human and spiritual caring dimensions (spiritual, ethical, humanistic, social), and the organizational context of hospital health care systems (with its economic, political, technological, and legal caring dimensions).

THE NATURE OF CARING

Caring is holistic and is the essence of nursing. Nurses and health care administrators in complex organizations recognize that caring, in the human health experience, facilitates excellence in nursing care, health care delivery, and patient outcomes. Caring is not only humanistic, spiritual, and an ethical phenomenon, but it integrates knowledge of the sociocultural environment, the technological, economic, political, and legal dimensions into its meaning structure and conceptual foundation. Caring, as complex, captures the genuine science of quality because its science is also the art of practice, an aesthetic which illuminates the beauty of the dynamic nurse–patient relationship, that makes possible authentic spiritual–ethical choices for transformation—healing, health, well-being, and a peaceful death. Thus, caring is universal and particular, ubiquitous in its appeal as the core of nursing philosophy, and particular in its diversity of expression in nursing practice.

Contemporary nursing practice focuses on creating caring environments for nurses, patients, and families within today’s complex health care organizations. With the emergence of the American Nurses Credentialing Center’s (ANCC) Magnet Recognition Program® (Magnet), nursing theory has moved from its central place in academia and research to practice. The majority of Magnet hospitals have implemented a theoretical framework grounded in caring science. The theme for the 2010 ANCC National Magnet Conference is “Magnet: A Culture of Caring.” Watson's (1985, 2005, 2008) theory of human
caring has become the theory of choice as direct care registered nurses (RNs) return to caring values. Theory-guided practice advances both the discipline and profession of nursing. Practice outcomes demonstrate the creation of a caring-healing environment, at all levels, and facilitate both human and environmental well-being (Ray 1981a, 2010b; Turkel & Ray, 2004; Watson, 2008).

**THEORETICAL EXEMPLARS OF CARING SCIENCE AND THE MUTUAL HUMAN–ENVIRONMENT PROCESS**

Nightingale (1859/1969, 1992) is credited as the “mother” of professional nursing. She laid the foundation for caring as central to nursing. Early in her life, Nightingale was concerned about others’ suffering, especially from her vantage point of considerable means. She was a deeply religious woman and believed that God called her to help others and to practice the art of charity, love of one’s fellow man (human), and a faith in God (Calabria & Macrae, 1994). Nightingale’s vision of nursing was seeing nurse caring actions as improving health through the reparative process of disease (dis-ease), which nature instituted (whom she articulated as God) within the human–environment relationship. Her work was not only influenced by her deep faith, but also by what she had experienced while traveling, training, and caring for wounded soldiers during the Crimean War. Nightingale was concerned about the human–environment relationship for enhancing healing and well-being. Nursing was not only the administration of medications and dressings, but also the proper use of fresh air, light, warmth, cleanliness, quiet, punctuality, and care, and the extreme importance of nursing in determining the issue of disease . . . “all at the least expense of vital power of the patient” (Nightingale, 1992, p. 6). Many of Nightingale’s ideas parallel the ways of thought and action present in nursing today. As such, Nightingale (Ray, 2010a) demonstrated the importance of nursing as nature and nurture in caring and health; the relationship among theology, spirituality, science, nature, environment, human action, and morals (ethics); the dynamic process of the nurse–patient caring relationship; the nurse as epidemiologist; employing evidence-based practice (from a knowledge of empirics and quantitative statistics); and nursing as open to interdisciplinary and cross-cultural practices. Thus, the importance of the human–environment caring relationship for health and well-being was born.

Rogers’ (1970) nursing science is a unique conceptual system with its origin in the unitary nature of the human–environment mutual process for healing and health. Rogers’ (1970) conceptual system is scientific, a synthesis of ideas and facts, and creative—as it describes an irreducible whole, the SUHB. Over many years, Rogers (1970, 1990) identified homeodynamic principles and finally established the concepts of resonancy, helicy, and integrality
to facilitate understanding and study of the continuous mutual human–environment process. *Resonancy* refers to continuous change in wave patterns in human and environmental fields, *helicy* is the continuous innovative, unpredictable, and increasing diversity of human and environmental field patterns, and *integrality* refers to the continuous mutual human field and environmental field process (Rogers, 1990).

While Rogers’ theory did not identify directly with complexity sciences, for example, the subsets of quantum theory, chaos theory, or the theory of complex adaptive systems, her vision was synchronous with many concepts common to complexity sciences (Briggs & Peat, 1989; Peat, 2002): evolving dynamic irreducible, nonrepeatable and nonlinear processes, wave patterning, energy fields, increasing complexity, greater diversity, timelessness, facets (suggests fractal patterns or ubiquitous wholes that are self-similar), and emergence (Reeder, 1984; Rogers, 1970, 1990). The implicit SUHB philosophy always begins with the unitary nature of the human and environment in mutual process, which is continually open and emergent. Thus, locality and space and time properties are not absolute and emerge anywhere. This idea shows the unpredictable, increasingly diverse, and emergent patterning that becomes manifest as humans and the environment dynamically evolve. This patterning unfolds in nursing within the nurse–patient relationship, the unitary nature, and increasing complexity of the mutual human and environment field process.

Although Rogers viewed caring as important within nursing, she did not embrace it as a substantive area (Smith, 1999; Watson & Smith, 2002). She did, however, embrace the notion of unconditional love, not as a substantive area of study, but as critical to nursing practice. In the Rogerian sense, love is considered a unitary, irreducible mutual human-environmental energy field process (Rogers, 1990; Smith, 1999). As Rogers and others engaged with the study of the SUHB were advancing their ideas of the unitary nature of the mutual human-environment process, scholars in the caring sciences were philosophizing about the nature of caring as love and a human and spiritual connectedness. The religious or divine interconnectedness of caring, the caring consciousness of nurses (caritas or charity and compassion and loving kindness) can be understood as a higher human-environmental field process (Ray, 1981b, 1997, 2010a, 2010b; Smith, 1999; Watson, 2005, 2008; Watson & Smith, 2002).

Smith (1999) wrote an extensive comparison and contrasting of the SUHB and caring, and identified patterns of caring meanings that are both implicit and explicit in the SUHB, such as (a) manifesting intentions (creating, holding, and expressing thoughts and will for caring–healing and well-being) (Purnell, 2006; Reeder, 1984); (b) appreciating pattern (the discovery of knowing wholeness and essence) (Cowling & Repede, 2010); (c) placing value on the other as lovable or worthy of being loved; (d) acknowledging
the emergence of pattern (Ray, 1997, 2010a); (e) attuning to dynamic flow, for example, attuning to the rhythmic dance within the continuous mutual process—being present in the moment (Boykin & Schoenhofer, 2001) or in the caring science of Watson (1985, 2005, 2008), the caring moment; (f) experiencing the infinite or the pandimensional awareness of the coextensiveness of the universe within the context of human relating (Ray, 1997; Watson, 2005, 2008); and (g) inviting creative emergence or reflection of the transformative potential of caring for self and other and the belief in the continuing innovation of emergent patterning and the panorama of possibilities (Davidson & Ray, 1991; Davidson et al., 1997, 2006; Ray, 1998; Smith, 1999). From a trans-theoretical viewpoint, a human being is a caring energy field with information rooted in the body, interacting with the caring energy and information of others and the universe (Cannato, 2010).

Watson's (1979, 1985, 2005, 2008) philosophy brought to light caring science as the essence of nursing and as the foundational core of the discipline. Caring is a dynamic transpersonal relationship between the nurse and the patient that involves ethical choice and action within the present moment (past, future, and present all at once), which manifests the potential for harmony of body, mind, and soul (spirit) (Watson, 1985, 2005, 2008). Thus, the process of caring is a moral ideal committed to a specific end, “... the protection, enhancement, and preservation of the person's humanity which helps to restore inner harmony and potential healing” (Watson, 1985, p. 58). Caring consists of the 10 caritas processes, or caring practices as they have been referred to by RNs in the practice setting, and are known to facilitate healing. Caritas nursing practice involves working from a human-to-human connection, a practice that is “heart-centered.” Watson's (2008) caritas processes are exemplars of caring science. Watson's theory continues to be advanced in the practice setting as RNs transform from a focus on the tasks of nursing to “the practice of loving kindness, authentic presence, cultivation of one's spiritual practices, and being in the caring–healing environment and allowing for miracles” (Watson, 2008, p. 34). Watson's philosophy and research reveals that we must become increasingly aware of who we are, the nature of and mystery of caring, and how we influence others and the environment in terms of the choices made for caring, which is life giving for all.

**WATSON’S CARITAS PROCESSES**

The 10 caritas processes grounded in the tenets of philosophy and ethics potentiate the creation of a caring–healing environment for nurses, patients, and families. RNs from various practice settings developed the caritas literacy, where various attributes of the caritas processes were identified and inform the profession of nursing. A brief overview follows.
Caritas Process 1: *Cultivating the Practice of Loving Kindness and Equanimity Toward Self and Others* involves listening and respecting others, honoring human dignity, treating self and others with loving kindness, recognizing vulnerabilities in self and others, and accepting self and others as they are.

Caritas Process 2: *Being Authentically Present: Enabling, Sustaining, and Honoring the Faith, Hope and Deep Belief System and the Inner-Subjective Life World of Self and Others* means creating opportunities for reflection, silence, and pause; promoting intentionality and human connections with others viewing life as a mystery to be explored rather than a problem to be solved; and interacting with caring arts and sciences to promote healing and wholeness.

Caritas Process 3: *Cultivation of One’s Own Spiritual Practices and Transpersonal Self, Going Beyond Ego-Self* means practicing self-reflection, transforming tasks into caring–healing interactions, demonstrating genuine interest in others, and valuing the goodness of self and others as human beings.

Caritas Process 4: *Developing and Sustaining a Helping-Trusting Caring Relationship* includes the concept of a caring moment where the experience transforms both nurse and patient. This involves the practice of authentic presence, holding a sacred space for healing in others’ time of need, and entering into the experience to explore the possibilities in the moment and in the relationship.

Caritas Process 5: *Being Present To and Supporting the Expressions of Positive and Negative Feelings* means creating and holding sacred space (a safe space for unfolding and emerging); encouraging story telling as a way to express understanding, allowing the story to emerge, change, and grow; and encouraging reflections of experiences and feelings.

Caritas Process 6: *Creative Use of Self and All Ways of Knowing as Part of the Caritas Process: Engage in the Art of Caritas Nursing.* In practice, a caritas nurse uses self to create healing environments via intentional touch, artistic expression, journaling, music, and play; integrates aesthetic, empirical, ethical, personal, and metaphysical ways of knowing into practice; and helps others to find new meaning in their journey.

Caritas Process 7: *Engage in Genuine Teaching-Learning Experience that Attends to the Unity of Being and Subjective Meaning Attempting to Stay Within the Other’s Frame of Reference.* In nursing practice, these calls for a focus on honoring the wholeness of persons, giving information to someone in a way they can receive it, seeking to learn from others and understand their world view, and helping others understand how they are thinking about their health.

Caritas Process 8: *Creating a Healing Environment at All Levels.* A caritas nurse creates space for: human connections to occur, caring intentions, and a healing environment by attending to nursing as environment, light, art, water noise, hand washing, and comfort measures.
Caritas Process 9: Administering Sacred Nursing Acts of Caring-Healing by Tending to Basic Human Needs. In practice this means seeing the wholeness of the patient, respecting patients’ special needs, involving the family or significant other in the plan of care, and transforming the tasks of nursing into sacred acts of love and caring.

Caritas Process 10: Opening and Attending to Spiritual/Mysterious and Existential Unknowns of Life-Death or Allowing for Miracles. This is often difficult to grasp or explain. The caritas nurse is comfortable dealing with the unknown, being open to possibilities, and nurturing and supporting.

As RNs are returning to acknowledging the humanity of nursing through caring practices, health care is transforming and new visions for the future are being cocreated. As Watson’s caring science continues to transform practice and the system, traditional outcome measures will not capture the essence of caring moments or allow for miracles. However, the emergence of new and innovative approaches to measure success or outcomes, such as human flourishing, purposeful involvement, and building capacity will occur.

Watson (2008) remarked, “A Caring Science/Caritas orientation to nursing education intersects with the arts and humanities and related fields of study, beyond the conventional clinicalized and medicalized views of human and health-healing” (p. 255). Therefore, to facilitate successful health and healing outcomes, and to advance our knowledge of what it means to be human, Watson (2008) spoke about the importance of advancing caritas education in all arenas. Watson emphasized that a caring science “engages with the diversity of the sciences and humanities and the notions of personal growth, of transformative learning by which the terms in which people think and the words they speak can actually be changed in educative situations” (p. 258). By engaging Watson’s caring science as caritas (love, ethics, mystery, transcendence) with, for example, the SUHB, and Ray’s theory of bureaucratic caring (highlighting organizations and caring), and the philosophy and research of the sciences of complexity (interconnectedness, self-organization, emergence), a greater understanding of science and the arts will emerge that will, in effect, change the world from disengagement, competition, and violence to compassion, justice, and peace.

RAY’S THEORY OF BUREAUCRATIC CARING

Ray’s (1981a, 1984, 1989, 2006, 2010a, 2010b; Coffman, 2006, 2010; Ray & Turkel, 2010; Turkel, 2001, 2006, 2007) theory of bureaucratic caring helps us to see how we can look at complex health care, community, and global systems so that the caritas processes that Watson (2008) articulates can be more understood and better implemented in practice. Health care organizations are hierarchical and exhibit leadership and management system processes that
manifest some degree of power, authority, and control for effective functioning. Hospitals therefore tend to be bureaucratic; that is, they are not only places for the care of the sick, but they also are integrated technical-politico-economic and legal organizations. These contextual patterns serve to facilitate efficient and effective functioning of the system. Although new approaches to leadership have been proposed, such as self-governing systems more often than not, workplace communities survive because of knowledge of their economic, technical, legal and political integrative patterning. Thus, organizations are complex and dynamic cultural systems that people consciously developed for the purposes of coordinating activities for specific ends (Wheatley, 2006). In health care, these ends are an efficient organization and healthy patient outcomes.

Organizations are small cultures. Cultures are co-created by people as they interact and construct meaning from diverse or common values, beliefs, attitudes, and behaviors that are communicated and transmitted from one group to another over time. Organizational cultures deal with values and beliefs about what they are there for, products they may produce, how they govern and manage, how they use technology, and how they deal with human relationships—employer–employee ideologies and social interactions (Bar-Yam, 2004; Perrow, 1986). As such, organizations as small cultures include most social structural elements that are visible in society, such as human systems, political, economic, technical, legal, ethical, religious/spiritual, and educational systems. Thus, highly concentrated organizational cultures are woven into meaningful dimensions of the social structure in order to make sense out of what occurs among people and professions in a given system. Today, organizational cultures comprises patterns of behavior, social norms, complex adaptive systems, creative ideas, complex problem-solving processes, explanatory models, and action, including spiritual–ethical caring action (Bar-Yam, 2004; Ray, 2010).

To more fully understand the theory of bureaucratic caring, it is necessary to understand the nature of bureaucracy as it relates to the theory. Developed over many centuries of Western civilization, complex organizations were recognized as rational–legal forms of bureaucracy, with a bureaucratic model finally identified by Max Weber in 1947 (Boone & Bowen, 1980). The process acknowledged key elements of a rational–legal system that included the major areas and tools of economic, political, social, technological, and legal dimensions that we recognize in complex systems today. Within a bureaucracy (organizational culture), diverse people cocreate and construct the meaning of their complex and dynamic social reality through social interaction. Within a bureaucracy, the interplay of communication and ethical choice making within relationships form a moral community within the workplace community; this social interaction sets the moral tone of the work life environment (Turkel & Ray, 2000, 2001, 2004, 2009). Bureaucracy, thus, is a social tool that identifies the dynamics of relational authority, power, control,
and ethical behavior that has an influence on what we value and how we think and reason in work life interactions (Perrow, 1986).


Through her research, Ray (1981a, 1984, 1989, 2006, 2010a, 2010b; Coffman, 2010; Ray & Turkel, 2010) also discovered how the context itself (the bureaucracy) played a role in the meaning structure of caring, identifying both substantive and formal theories, differential caring and a synthesis, bureaucratic caring. The theory is holographic (Coffman, 2010; Ray, 2006, 2010a; Ray & Turkel, 2010). Caring is a whole, yet is a part of the complexity of a hospital, and in essence, the society at large. Within the differential caring theory, caring in the complex organization of the hospital differentiated itself in terms of meaning by its unit context—dominant caring dimensions related to areas of practice or units wherein professionals worked and patients resided.

Differential caring theory also showed that different units espoused different (dominant) caring meanings based on their organizational goals and values, such as technological caring in intensive care units or surgical suites, humanistic and spiritual caring in the oncology unit, and legal, economic, and political caring in the administrative environments (Ray, 2006; Ray & Turkel, 2010).

In this light, differential caring was organized into a hierarchical structure (psychological, practical, interactional, philosophic) from data on the meaning of caring (Ray, 1981a, 1984, 2010b). Here, the data revealed that differential caring theory is an expression of beliefs and behaviors relating to competing technological, ethical, religious, political, legal, economic, educational, humanistic, and social factors of the organization and dominant culture.

For its part, the formal theory of bureaucratic caring emerged by integrating the qualitative data from interviews, participant–observations of the hospital culture, and the interpretation of meaning of caring using an Hegelian philosophy of thesis, antithesis, synthesis: illuminating the thesis of caring (a meaning system) in relation to the potential antithesis of caring (the hospital as a bureaucracy) to a synthesis, the theory of bureaucratic caring. The theory illuminates the nature of caring as the integration of humanistic,
social, ethical, religious/spiritual, political, economic, technological, and legal caring. By researching and understanding the meaning of caring, nurses and other professionals showed the uniqueness of caring as an expression of the complex human-environment mutual process. To capture this uniqueness of caring within contemporary nursing practice in complex organizations, the nursing process has been reconceptualized with a new mnemonic: recognizing, connecting, partnering, and reflecting (RCPR) (Turkel & Ray, in press).

**COMPLEXITY SCIENCES AND NURSING**

Complexity sciences, called the science of quality, look to networks of relationship as the underpinning for choices in the continual and emerging mutual human–environment process (Bar-Yam, 2004; Briggs & Peat, 1989; Peat, 2002). Complexity sciences also fit the ontology (what we know about being) and epistemology (the way we know) of nursing science (Anderson et al., 2005; Davidson & Ray, 1991; Davidson et al., 1997; Lindberg, Nash, & Lindberg, 2008; Ray, 1994, 1998). The mutual human–environment process for both complexity sciences and nursing science involves phenomena that are complex, dynamic, relational, nonlinear, structurally similar, integral, pandimensional, holonomic, difficult to study, qualitative, self-organizing, and open to emergence. The human–environment mutual process recognizes the unitary nature of the human and the environment—everything in the universe is interdependent; is sensitive to initial conditions (hysteresis); is patterned; evolves over space and time, is similar through constant change (homeodynamic) but never again exactly the same (irreversible); has "properties" that arise in the act of observation itself; has phenomena that are capable of filtration (choice) by involved agents-in-relationship; and has phenomena that self-organize (change or transform). Thus, there is continuous emergence (Bar-Yam, 2004; Briggs & Peat, 1989; Davidson & Ray, 1991; Peat, 2002; Ray, 1994, 1998). In nursing science, the mutual process of humans and the environment evolves toward health, healing, or well-being through the caring relationship. This transformation is relational self-organization (Ray, 1994).

Complexity sciences and nursing science have the power to promote a deeper understanding of human beings as they evolve with the environment. It is a symphony of mutual continuous change or transformation: “The complexity and the interdependency of agents who interact in a self-organizing manner make it impossible for any single agent to control the processes and outcomes of care for any patient” (Wiggins, 2008, p. 11). However, relational caring self-organization in nursing exposes the power and energy of the caring relationship and the caring moment (Watson, 2008). Choice within networks of relationship or honoring the patient and family through caring cocreates a
living organization (Nirenberg, 1993) where “seeing” with the body, mind, and soul (spirit and heart) symbolizes loving kindness, caring communication, and mystery. There is a deep spiritual meaning to caring in the mutual human–environment process (Watson, 2008). In a world of many complex dimensions, the available information exceeds more than what our senses perceive.

Choosing the best ethical and spiritual action is based on information gathered from the multidimensionality of patients' and families' clinical caring experiences by nurses and other professionals who have moral commitment and caring knowledge, and use their intuition (intention and practical wisdom) to cocreate change and relational self-organization. Intuition, which reflects the art of nursing, is a dimension of Watson's (2008) theory of human caring as described in Caritas Process 6 (which calls for Creative Use of Self and All Ways of Knowing as Part of the Caritas Process: Engage in the Art of Caritas Nursing). This concept of intuition is nonlinear and requires the nurse to be open to innovation and creativity in nursing practice. As a complex human concept, intuition is one of the multiple ways of knowing that is acknowledged by a caring nurse as he/she comes to know and understand self and patient as a caring person.

AN INVITATION

The authors invite all who read this book to reflect on each chapter and the responses that follow each chapter. Here, reading requires an open mind, letting go of conventional ways of thinking, and a willingness to move beyond one's comfort zone as one opens up to emerging possibilities. This book, a unique contribution to the discipline, is the first to focus on both caring science and complexity sciences within the realm of nursing science, practice, and health care organizations. The commonality between caring science and complexity sciences is the human connection, the relationship, and the pattern recognition that facilitates understanding of the mutual human and environment process for emergence of health, healing, well-being, or a peaceful death.

The vision for this book grew out of the commitment, passion, and dedication of the co-editors, the late Dr. Alice W. Davidson, one of the first nursing scholars to advance nursing and complexity sciences; Dr. Marilyn Ray, who integrated caring science and complexity sciences in contemporary nursing theory and health care practices; and Dr. Marian Turkel, who is committed to the teaching and implementation of caring science in complex health care systems and research initiatives.

The chapters and responses with a variety of practice exemplars in this book describe, explicate, and reflect unique trans-theoretical approaches that converge tenets from the philosophies of caring sciences, the SUHB, and complexity sciences. Scholars with knowledge related to caring science, the
SUHB, and complexity sciences contributed to this book. The chapters and responses are diverse, illuminating the diversity of complexity itself, but similar in the underlying articulation of and need for human caring and concern for the delivery of quality health care. There are chapters more focused on complexity sciences, highlighting, for example, entropy, methods, organizational paradoxes, and conflict relationships from more theoretical, quantitative, and/or mathematical research approaches. There is a chapter focused on the disease process of diabetes that shows the complexity of diabetes from the cellular to policy levels. There are chapters focused on theoretical and qualitative research methods or newer research methods capturing the science of complexity, such as the comparing and contrasting of complexity sciences and the SUHB, complex caring dynamics, and story theory and method. There are chapters related to leadership, caring in complex health care organizations, and nursing education that address both complexity and caring sciences. And finally there are chapters that challenge our ethical thinking with informatics applications in practice, and the future of nursing and caring within the realm of the human–humanoid relationship.

Each chapter begins with an introductory preface describing the relevance of the content to contemporary complexity science, nursing, and caring sciences for human–environment well-being. Each chapter has a response, and sometimes two responses, that highlight what the particular chapter means to nursing education, research, leadership, administration, and practice. Responses provide the reader with a practical application or understanding of the content presented. Three types of responses were offered to the response authors: (a) a structured contextual template, (b) a response to open-ended questions, and (c) an open emergent and reflective process. Response authors chose what illuminated or critiqued ideas in the chapter and many offered new approaches based upon nursing research or clinical practice applications.

Readers are invited to engage in personal reflection on the relevance of the writings as they relate to theory, research, education, leadership, and practice. The Epilogue and Addendum at the end of the book provide challenging questions and practical definitions of terms from nursing and complexity sciences to further demonstrate how nurses, physicians, and health care leaders can use or continue to embrace the use of caring in the mutual human–environment relationship in education, research, administration, leadership, and practice.

REFERENCES


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As Maturana and Varela remarked in their book *The Tree of Knowledge* (1992):

*We have only the world we can bring forth with others, and only love helps bring it forth . . . .* (from Goodwin, B. [2003]. Patterns of wholeness: Holistic science. *Resurgence*, 1[216], p. 14)

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The ideas embedded in complexity science are receiving increasing attention in many disciplines struggling to describe and explain phenomena in their fields of study. There is growing appreciation of the inadequacy of conventional models for understanding complex interrelated systems, and this accounts for the emerging applications of complexity science in the physical, behavioral, biological, and human sciences. Nursing science has focused on complex systems in the study of nursing phenomena. The discipline of nursing is the study of relationship, human–environment patterning, and the complex dynamics related to caring and healing. Rogers’ science of unitary human beings (SUHB) has embedded within it many concepts consistent with complexity science. Complexity science is the transdisciplinary study of complex adaptive systems (CAS); it encompasses multiple theoretical perspectives and methods of inquiry and comprises a large number of entities displaying a high level of nonlinear (or noncausal) interactivity. Nurse scholars have recognized the importance of the unitary nature of the human and environment in caring for others, the difficulty of isolating parts of the unitary human–environment process, and the complexity or choices within continual emergence and change. In 1970, Rogers defined the unitary human–environment process as continuously changing, irreversible, and evolving toward increased innovation, diversity and higher frequency wave patterning. Building upon this foundation, the purpose of this chapter is to describe the interrelationships among select philosophic and theoretic perspectives in nursing and concepts in complexity science. Both Perkins and Reeder illuminate how there is a conceptual integration of complexity sciences, the SUHB, and caring in nursing. In this way they point out the uniqueness of nursing as a unitary caring science.
been one of the early adopters of ideas related to complexity science. With the discipline's focus on the study of human health and healing through caring (Smith, 1994) or person–environment relationships that facilitate health (Fawcett, 2000), relationship emerges as central to the ontology and epistemology of nursing (Newman, Smith, Dexheimer-Pharris, & Jones, 2008); therefore, the study of relationships and approaches that account for interconnectedness and dynamism is essential. Multiple paradigms have emerged in nursing, with the unitary–transformative paradigm (Newman, Sime, & Corcoran-Perry, 1991) reflecting some of the distinguishing tenets of complexity science. This paradigm had its origins in the conceptual system for nursing developed by Martha Rogers (1970), the SUHB. Rogers introduced a worldview that posited humans and the environment as patterned energy fields without boundaries that were continuously changing and creatively emerging. The concepts within other nursing theories correspond with complexity thinking. The purpose of this chapter is to describe the interrelationships among selected philosophic and theoretic perspectives in nursing and concepts in complexity science. An overview and definition of the concepts in complexity science will be presented first, followed by an analysis of the fit with selected nursing theories. The chapter ends with some speculation about ways in which these ideas will continue to shape the direction of nursing inquiry, practice, and education for the future.

Salient Concepts in Complexity Science

The literature is rife with multiple meanings of complexity science. In illuminating the “perplexity in complexity science,” Horgan (1995) reported that there were 31 definitions of complexity; most likely, there are many more in existence now. Fundamentally, complexity science is the transdisciplinary study of CAS; it encompasses multiple theoretical perspectives and methods of inquiry. Richardson, Cilliers, and Lissack (2000) provide a simple definition of a complex system as one “that is comprised of a large number of entities displaying a high level of non-linear interactivity” (p. 8). “Complexity science examines systems comprised of multiple and diverse interacting agents and seeks to uncover the principles and dynamics that affect how such systems evolve and maintain order” (Lindberg & Lindberg, 2008, p. 32).

Those espousing reductionistic perspectives of complexity science assert that the simple rules underlying complex patterns can be sorted out through mathematical models; others disagree. Some assert that the concepts of complexity science are not really being applied authentically in some disciplines but instead are used as metaphorical tools to explain observed phenomena (Haigh, 2002). For example, concepts such as the edge of chaos, emergence, and far from equilibrium may be used metaphorically
to describe an observed dynamic of a system. When applied in this way, the
tenets of complexity are not ontological, or definitive of the nature of reality,
but rather are adopted as an epistemological tool (metaphor) to understand
an aspect of reality through comparison (Richardson & Cilliers, 2001). This
might be considered as a pseudoscientific application of the thinking within
complexity science and not the actual science itself. Some complexity sci-
entists approach the study of complex systems through the methods of logical
positivism, whereas others embrace methodological pluralism characteristic
of a postmodern view. Phelan (2001) differentiates complexity science from
complexity pseudoscience. Science involves the development and testing
of theory through research. In contrast, pseudoscience uses resemblance
thinking, neglects empirical matters, and is oblivious to alternative theories.
Both complexity science and pseudoscience exist in nursing. Phelan argues
that complexity theory and complexity thinking should be replaced with
complexity science in some cases when the meaning reflects multiple ways
of knowing, which, he argues, are not scientific. The dialogue related to
complexity science is, in itself, complex. Choosing and defining one’s own
perspective is necessary when clarifying one’s position among these multiple
points of view.

Perhaps the most encompassing notion of complexity science situates it
as a worldview that underpins a particular philosophy of science. The pur-
pose of any science is to create organizing frameworks to explain some aspect
of reality and then to examine those frameworks for their empirical honesty
(Smith, 1994). Dent (2000) asserts that “complexity science is an approach to
research, study and perspective that . . . [embraces] the philosophical assump-
tions of the emerging worldview” (p. 5). A variety of authors (Bohm, 1980;
Briggs & Peat, 1989; Capra, 1982; Ferguson, 1980; Harman, 1998; Prigogine &
Stengers, 1984; Wilber, 1998) have described this emerging worldview and
argue that its appeal is related to the recognition that the traditional or
empirical–analytic–mechanistic worldview underpinning science from a logi-
cal positivist perspective is inadequate. This traditional worldview provides
some guidance for understanding phenomena within certain conditions, but
beyond those conditions, its explanatory power is limited. Therefore, the
emerging worldview encompasses the traditional within the limitations of
its applicability while moving beyond it to explain the unexplainable within
its perspective. This shift from the traditional to the emerging worldview is
described as a time of dislocation (Ackoff, 1981), a period between “stories”
(Schwartz & Ogilvy, 1979), a turning point (Capra, 1982), or new paradigm
thinking (Ferguson, 1980).

Table 1.1 is adapted from Dent (2000) and contrasts features of the
traditional and emerging worldviews. The traditional or empirical–analytic–
mechanistic worldview is consistent with Newtonian physics and its conse-
quents of reductionism, discrete parts, local relationships, linear causality,
objective reality, dualism, and a reliance on logic, prediction, averages,
and homogeneity in the scientific method. In contrast, a quantum reality can acknowledge the Newtonian worldview in some circumstances, but its perspective also can embrace holism, patterns, relationships, nonlocal and nonlinear processes, indeterminism, perspectival and cocreated reality, paradox, polarity, diversity, and emergence. Gleick (1987) predicted that the three scientific theories from the 20th century most relevant for the 21st century would be the relativity, quantum, and chaos theories. The emerging worldview reflects these theories. Any theory is a map of the territory (reality); the real territory is always more complex than any map can depict. Each theory explains a range of phenomena; however, it may be totally inadequate for others. The emerging theories of complexity science address some of the unexplained gaps inherent in the traditional worldview (Capra, 1982; Coppa, 1993).

The structure of traditional and emergent worldviews corresponds to the worldviews underpinning paradigms within nursing science. These ontological paradigms contrast the different views of the nature of human beings, human–environment relationships, and health that shape approaches to nursing epistemology, methodology, and practice. Parse (1987) describes

<table>
<thead>
<tr>
<th>TRADITIONAL WORLDVIEW</th>
<th>EMERGING WORLDVIEW</th>
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<tbody>
<tr>
<td>Reductionism</td>
<td>Holism</td>
</tr>
<tr>
<td>Focus on parts</td>
<td>Focus on patterns</td>
</tr>
<tr>
<td>Focus on discrete entities</td>
<td>Focus on relationships</td>
</tr>
<tr>
<td>Linear causality</td>
<td>Mutual causality</td>
</tr>
<tr>
<td>Local and linear relationships</td>
<td>Nonlocal and nonlinear relationships</td>
</tr>
<tr>
<td>Determinism</td>
<td>Indeterminism, unpredictability</td>
</tr>
<tr>
<td>Objective reality</td>
<td>Perspectival reality; cocreated reality</td>
</tr>
<tr>
<td>Observer outside the observation</td>
<td>Observer influences the observation</td>
</tr>
<tr>
<td>Systems adapt to stimuli</td>
<td>Systems self-organize</td>
</tr>
<tr>
<td>Logic</td>
<td>Paradox</td>
</tr>
<tr>
<td>Either/or thinking</td>
<td>Polarity thinking</td>
</tr>
<tr>
<td>Founded on Newtonian physics</td>
<td>Founded on quantum physics</td>
</tr>
<tr>
<td>Prediction</td>
<td>Understanding/sensitivity; analysis/explanation</td>
</tr>
<tr>
<td>Averages; homogeneity</td>
<td>Diversity, variation</td>
</tr>
<tr>
<td>Focus on outcomes</td>
<td>Focus on emergence</td>
</tr>
<tr>
<td>Matter creates mind</td>
<td>Presence of consciousness in mind matter</td>
</tr>
</tbody>
</table>

(Adapted from Dent, 2000)
two paradigms in nursing: the simultaneity and the totality. Those with the lens of the totality paradigm perceive persons as composed of interrelated and interacting dimensions or parts; person and environment are separate but interactive, and health is biopsychosocial well-being, often depicted on a continuum from wellness to illness (or death). Parse (1987) asserted that Rogers’ Science of Unitary Man (sic), now the Science of Unitary Human Beings (SUHB) published in 1970, ushered in the simultaneity paradigm. In this paradigm person-environment is viewed as an irreducible whole and health as a pattern of the whole. In 1991 Newman, Sime, & Corcoran-Perry named three paradigms in nursing as the particularistic–deterministic, the interactive–integrative, and the unitary–transformative. The deterministic perspective corresponds closely with the traditional worldview; the interactive–integrative worldview offers a systems perspective that acknowledges human adaptation to the environment and the expression of this adaptation in subsystems. The unitary–transformative paradigm in nursing corresponds to the emerging worldview. Coming from this perspective, science is conducted differently. There is an attempt to understand “the evolving pattern of the whole” (Newman, 2008, p. 14). Nursing theories are clustered under these worldviews. The simultaneity and unitary–transformative paradigms have close similarities with the emerging worldview and complexity theory. This paradigm asserts the existence of human–environment patterning that reflects a fundamental wholeness, a dynamic process of change, and creative emergence based on participation and growing complexity.

As stated earlier, complexity science is known also as a theory of complex adaptive systems (CAS). In Table 1.2, the defining elements of CAS are identified. CAS are characterized by qualities such as embeddedness, nonlinearity, unpredictability, self-organization, diversity, porous boundaries, and emergent behavior (Chaffee & McNeill, 2007; Lindberg & Lindberg, 2008). Chaos theory is a subset of complexity science; its central tenet is that order underlies and emerges from apparent disorder. Although turbulent systems seem to exhibit chaotic behavior, order emerges from a communication point or phase space (Ray, 1998).

CAS are composed of interdependent and adaptive elements. There is a fundamental assertion that there is a simple rule that when discovered will show the unity of the life sciences (Lewin, 1992). The internal structures of complex systems are not reducible to a mechanical system (Allen, 2001, p. 30). These systems coevolve with their environment, open to flows of energy, matter, and information (p. 39). The evolution is creative and uncertain. There is a changing system embedded in a landscape of potential attractors that influence change. This is “transformational teleology” (Stacey, Griffen, & Shaw, 2000) as the potential futures (patterns of attractors) are transformed in the present (Allen, 2001, p. 40).
<table>
<thead>
<tr>
<th>CONCEPT</th>
<th>DEFINITION</th>
<th>CORRESPONDENCE TO NURSING THEORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embeddedness</td>
<td>CAS exist within larger systems that provide context for understanding each.</td>
<td>Rogers' postulate of open systems and principle of integrality: Humans and environment are energy fields, coextensive with the universe and in continuous, mutual process. Newman describes individual patterns of consciousness embedded in family and community patterns. Roy's philosophical assumptions related to cosmic unity.</td>
</tr>
<tr>
<td>Dynamism</td>
<td>CAS are in continuous change; stability is not expected or desired.</td>
<td>Rogers' postulates and principles of helicy and resonancy: Change in human–environmental energy field is continuous, innovative, and unpredictable with greater diversity of field patterning. Roy describes persons as holistic adaptive systems with coping processes that maintain adaptation and promote person and environment transformations.</td>
</tr>
<tr>
<td>Patterning</td>
<td>CAS have unique configurations of movement and flow that identify each.</td>
<td>Rogers' postulates of energy field, open systems, and pattern and organization: Each energy field has a distinguishing pattern, a single wave that differentiates it from others. Newman's concept of pattern of the whole with movement, time, and space as patterns of evolving consciousness. Davidson stated that patterning could shift from stability to radical changes and that patterning over time should be studied through a perceptual dance between the parts and the whole.</td>
</tr>
<tr>
<td>Coevolution</td>
<td>CAS simultaneously shape and are shaped by their interactions with other systems.</td>
<td>Rogers' postulates of open systems: Human and environment energy fields are in continuous mutual process. Newman asserts that nurse and client evolve together in the mutual relationship. Parse's principle that humans are co-transcending with the possibles.</td>
</tr>
<tr>
<td>CONCEPT</td>
<td>DEFINITION</td>
<td>CORRESPONDENCE TO NURSING THEORIES</td>
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</tr>
<tr>
<td>Emergence</td>
<td>Creative and innovative change occurs at the edge of the system where there is the most disorganization and disorder.</td>
<td>Rogers’ principles of helicy. Change in human–environmental field patterning is continuous, innovative, and unpredictable. Humans and environment are evolving toward increasing complexity and diversity of field patterning. Rogers’ assumption of negentropy, that the life process is evolving toward greater complexity and order, was not consistent with the concept of order emerging from chaos. Newman’s ideas that disruption and disorder (disease) can lead to a choice point and expanding consciousness (health). Parse’s principle that human becoming as negentropic unfolding. Turkel and Ray describe the emergence of relational complexity as a creative change in the system when economics and caring are viewed in a dialectic whole. Reed asserts that growing self-transcendence occurs with aging and crisis.</td>
</tr>
<tr>
<td>Inherent integrity</td>
<td>CAS possess unity and structure.</td>
<td>Rogers’ postulate of pattern: Pattern provides integrity to the energy field; it identifies it and distinguishes it. Roy’s person as adaptive system emphasizes the importance of system integrity through stability and change. Adaptive responses promote integrity.</td>
</tr>
<tr>
<td>Nonlinearity</td>
<td>The direction of dynamic change in CAS is unpredictable. A small action by an agent may produce a large change in the CAS and vice versa.</td>
<td>Rogers’ postulate of open systems and principle of helicy: Human–environmental energy fields are in continuous mutual process. Change in human–environmental energy field patterning is continuous, innovative, and unpredictable. Attunement and resonance are nonlinear processes of acquiring knowledge.</td>
</tr>
<tr>
<td>Porous boundaries</td>
<td>CAS have open boundaries that permit continuous interaction with other systems.</td>
<td>Rogers’ postulate of energy fields and open systems: Energy fields, by their nature, have no boundaries; they are in continuous, mutual process. (continued)</td>
</tr>
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(continued)
### TABLE 1.2 (Continued)

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<th>CONCEPT</th>
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<th>CORRESPONDENCE TO NURSING THEORIES</th>
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<tbody>
<tr>
<td>Self-organization</td>
<td>CAS have the ability to influence their structure and direction by creating new patterns through interactions with other systems.</td>
<td>Rogers’ principle of helicy and Barrett’s theory of power as knowing participation in change: Change is continuous, dynamic, and creative, and humans participate knowingly in the process of change; humans participate knowingly in change through awareness, choice, freedom to act intentionally, and involvement in creating change. Newman’s ideas of transformation through pattern recognition; shifts occur as client recognizes own patterning. Davidson found that in complex human–environment interrelationships choice is important for well-being. Turkel and Ray describe the self-organizing characteristics of the work environment occurring as forces of economic accountability and need for relationship converge. Roy's scientific assumption: Systems progress to a higher level of complexity and self-organization.</td>
</tr>
<tr>
<td>Simple rules</td>
<td>Underlying CAS are rules that govern the behavior of interacting agents over time using feedback and algorithms. These rules, when discovered, will lead to a unity of the life sciences. The CAS evolves creative possibilities through learning as a whole.</td>
<td>Turkel and Ray describe a search for unity in relational complexity, a dialectic synthesis that resolves the tension between economics and caring. Ray defines caring as the energy by which choice is facilitated to bring order (healing or well-being) out of chaos (disease, need, pain, or crisis).</td>
</tr>
<tr>
<td>Diversity</td>
<td>Agents or elements in the CAS are varied and unique, and these differences are critical for system health.</td>
<td>Rogers described increasing diversity as a manifestation of patterning.</td>
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### Table 1.2 (Continued)

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<tr>
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<tbody>
<tr>
<td>Polarity and paradox: order–disorder</td>
<td>CAS are characterized by a wholeness that embraces dialectic rhythms. The fluctuations of these opposing forces are preferred over stability.</td>
<td>Rogers’ principle of resonancy asserts that human patterning evolves toward more diverse manifestations evident in opposing rhythms that evolve toward a unity (dialectic synthesis); for example, the pattern of sleeping, waking, and beyond waking. Newman asserts that the concept of health encompasses both disease and nondisease. Davidson states that chaotic patterns give rise to ordered patterns in human life. In Parse’s humanbecoming school of thought, the paradoxical rhythms of revealing–concealing, connecting–separating, and enabling–limiting describe the patterns of relating. The paradoxical rhythms reflect the whole. In their theory, Turkel and Ray focus on the paradox of economics and caring and its resolution in relational complexity.</td>
</tr>
<tr>
<td>Adaptable elements</td>
<td>CAS are composed of elements that can evolve with environmental changes.</td>
<td>Roy’s theory of adaptive system states that there are internal processes that act to maintain the integrity of the individual or group.</td>
</tr>
<tr>
<td>Distributed control</td>
<td>CAS do not direct change centrally; the agents participate in direction of change and resultant outcomes.</td>
<td>Rogers’ principle of helicy states that the nature and direction of change are a function of knowing participation in the human–environment process.</td>
</tr>
<tr>
<td>Attractors</td>
<td>System catalysts that promote the emergence of new behaviors.</td>
<td>Ray identifies caring as an attractor that moves the system toward order in chaos.</td>
</tr>
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Relationship of Complexity Thinking to Nursing Theories

In 1970, Martha Rogers published her groundbreaking book, *An Introduction to the Theoretical Basis of Nursing*. In this book, Rogers provided the foundations for her conceptual system, now called the science of unitary human beings (SUHB), offering a radical alternative to existing conceptualizations about the relationships between human beings, their environment, and the nature of the life process.

Rogers recognized the limitations of the existing models within science and medicine that reduced, categorized, and classified human phenomena and sought to predict human–environment relationships through hypothesizing the direction of reactions to environmental stimuli. This model led to prescriptions to change human behavior toward desired outcomes. Rogers proposed a nursing lens focused on the wholeness, interconnectedness, and complexity of the life process as the foundation for nursing science, with a goal of “better health for mankind [sic]” (p. xii). She drew from tenets of general systems theory, evolutionary biology and cosmology, relativity theory, and quantum mechanics in the creation of a wholly new conceptual system that, in many ways, preceded or paralleled the emerging foundations of complexity science. She argued against the application of systems theories to understand human life. Instead, she called for the life process to be understood in its wholeness as reflected in pattern and organization.

Rogers asserted that the life process is inherently complex and dynamic. “An energy field underwrites the unity of man [sic] and provides the conceptual boundaries which identify his [sic] oneness. A field transcends its component parts ... and possesses its own integrity. Human beings are more than and different from the sum of their parts” (p. 46). The notion of both humans and environments as energy fields sets the stage for a boundaryless integral relationship between the two. Human beings coevolve with their environment. This perspective contradicts the notions of orderly or predictable adaptation to environmental stimuli. Likewise, without boundaries between humans and the environment, there can be no predictable outcomes, only dynamic change cocreated through participation.

Rogers (1990, 1994) viewed living systems as continually becoming, that is, growing, more diverse and complex. This contradicted the second law of thermodynamics, entropy, setting the stage for its opposite, the concept of negentropy, the continuous, dynamic change toward greater complexity that characterizes human life. Emergence and unpredictability are natural consequences of this assumption. “The capacity of life to transcend itself, for new forms to emerge, for new levels of complexity to evolve, predicates a future that cannot be foretold” (Rogers, 1970, p. 57).

Rogers’ postulate of pattern and organization is founded on the premise that complex whole systems are known by their patterns. The energy field imposes pattern; pattern reflects the wholeness of human
life (Rogers, 1970, p. 61). Pattern is dynamic and observable through its manifestations. Self-regulatory or self-organizing characteristics of pattern, included in her 1970 book, were later rejected because of their violation of the coevolving, integral nature of the person–environment mutual process. Human beings participate knowingly in change (1990, 1994) through making choices, but they do not regulate or organize themselves in isolation. Rogers also argued that chaos theory was not consistent with a unitary perspective. She considered the premise of chaos theory, that if the conditions and context of any event are known the outcomes can be predicted, inconsistent with an open systems perspective. Furthermore, she found the idea that order emerges at the edge of chaos as contrary to a worldview where emergence is continually unpredictable, creative, and diverse.

Theories have been derived from Rogers’ conceptual system. One is the theory of accelerating evolution (Rogers, 1970, 1990), that more complex life forms evolve more rapidly and that change is accelerating. She suggested that we would witness more complex and diverse patterning manifestations such as hyperactivity, extrasensory perception, and changes in sleep–wake patterns over time. Perhaps the precipitous change in communication through technology is another example of this theory of accelerating evolution. Barrett’s (1986) theory of power as participating knowingly in change is another theory derived from the SUHB. Barrett asserts that humans have the power to participate in change through awareness, choice, freedom to act intentionally, and involvement in creating change. Her theory provides a blueprint for promoting participation in change within complex situations.

Rosemarie Parse’s (1998) *The Humanbecoming School of Thought* and Margaret Newman’s (1986, 1994) *Theory of Health as Expanding Consciousness* (HEC) were developed, in part, from Rogers’ SUHB; therefore, both of these theories fall within the simultaneity or unitary–transformative paradigms and resonate with the complexity theory concepts. The theory of humanbecoming (Parse, 1998) (formerly man-living health [Parse, 1981]), by its name, suggests that a process of emergence characterizes health. Parse asserts that human beings cocreate patterns of relating with their environments. These patterns manifest in the paradoxical rhythms of revealing–concealing, connecting–separating, and enabling–limiting. From Parse’s perspective, these rhythms constitute the pattern of a whole. Humanbecoming is co-transcending with the possibles. These themes, embodied in the theory’s principles, are consistent with complexity thinking related to interconnectedness, paradox, and emergence.

Margaret Newman’s theory of *Health as Expanding Consciousness* (HEC) (1986, 1994) draws from Rogers’ (1970) SUHB, Young’s (1976) theory of the evolution of consciousness, Bohm’s (1980) theory of the holographic universe, and Prigogine’s (1984) theory of dissipative structures, all of which have correspondence with selected ideas in complexity science. “The focus is on the person, the pattern of the evolving whole, of transformations within
transformations, including the unpredictability of chaotic systems” (Newman, 2008, p. 8). According to Newman, health is a higher unity encompassing both having disease and being free from it. Having a disease may be an impetus for movement to a choice point and a higher level of organization. This relates to Prigogine’s (1984) theory in which a period of disorganization can be the impetus for movement to a higher level of organization. Persons experiencing the disruptive patterning associated with disease may arrive at a choice point where they develop awareness, recognize their pattern, make decisions, and take actions that become life transforming. This is expanding consciousness. According to HEC, knowing through attunement and resonance is a more complex way of knowing the whole that may result in intuitive insights and revelation (Newman, 2008, p. 37). This process of seeing the whole in parts is a key to pattern recognition. These ideas are consistent with the concepts of creative emergence, hidden unity, and self-organization related to complexity theory.

Sr. Callista Roy’s (2008) conceptual model of person as adaptive system has evolved over time, incorporating some qualities related to complexity science and complex adaptive systems. Her model evolved from general system theory and adaptation theory, and later, she incorporated from Young (1976) the ideas of unity and meaningfulness in the created universe. Her recent work (Roy, 2009; Roy & Jones, 2007) places greater emphasis on the complexity of the times in which we live and how this compels the need for greater unity and spiritual vision. Roy’s philosophical assumption related to cosmic unity reflects the interconnectedness of persons to a larger whole. In her scientific assumptions, Roy (2010) states that systems of matter and energy progress to higher levels of complex self-organization; that consciousness and meaning are consistent with person and environment integration; that choice results in the integration of creative processes; that there are integral relationships between persons and the earth; and that person and environment transformations have created human consciousness (p. 170). These scientific assumptions clearly reflect a movement toward a unitary–transformative worldview consistent with the fundamental premises of complexity science.

Pamela Reed’s (1991) middle range self-transcendence theory was built on assumptions from Rogers’ SUHB. Reed defines living systems as open, self-organizing, and developing through periods of disequilibrium. She asserts that in the life process humans develop in the direction of greater complexity. One of the indicators of this is growing self-transcendence, and this quality is often seen in the aging process. However, self-transcendence can be accelerated during times of vulnerability or crisis, when persons experience deeper connections to self and others and an increasing focus on contributing to a greater good.

Alice Davidson, under the guidance of her doctoral mentor, Marilyn Ray (Davidson & Ray, 1991), was one of the first nursing scholars to draw explicitly
from the tenets of complexity science in her research related to human–environment interrelationships. She built on Rogers’ (1970, 1990) principle of integrality and asserted that patterns may appear stable or can shift dramatically from previous patterning. Davidson hypothesized that apparent chaotic patterns may give rise to greater order in human life and that humans come to know the environment through a perceptual dance of focusing on parts and the whole. This dialectical movement is essential to understanding the complex, relational, human–environment process. In order to understand this, Davidson designed a study using multiple methods to examine complex relationships. Her process of studying the human–environment relationship evolved from complexity theory and included the following: (1) apprehension of the whole to determine data needed; (2) examination of the manifestations of the whole collected as data; (3) analysis of data according to the appropriate traditional paradigm; (4) dialectical movement among the findings; (5) pattern identification across paradigms; (6) application of boundaries of existing understandings from data, literature review, and so on; (7) boundary crossing by reversing and questioning; (8) disengagement and enabling ideas to be transformed into new patterns or creative insights of meaning making; (9) intuiting an understanding of the phenomenon (unity of meaning), and; (10) communicating meaning to others through language and practice (p. 77).

Davidson’s research question was: How does the integral human–environment relationship facilitate human beings’ well-being as manifest in production and creativity? Participants were workers within an organization. Data generation included the following: participant observation and action research; causal modeling; phenomenology and hermeneutic analysis of the totality of the data. Based on her research, she developed a theory of choice patterns, asserting the importance of choice for human beings as they promote their own unique well-being. Later Davidson and colleagues (Davidson, Teicher, & Bar-Yam, 1997) tested this theory and found that for the elderly to remain active and productive they needed sufficient complexity in their human–environment relationships to stimulate and challenge them.

Several nurse scholars have written about the relationship of chaos theory to nursing theories (Mishel, 1990; Vicenzi, 1994; Ray, 1994). Gleick (1987) defines chaos as the apparent irregular, unpredictable behavior of deterministic, nonlinear dynamic systems. It is referred to as “deterministic randomness” (Vicenzi, 1994, p. 37). Mishel (1990) used chaos theory as a way to reconceptualize her middle range theory of uncertainty in illness to reflect the changes that occur in people when uncertainty is prolonged. Disorder, instability, diversity, and disequilibrium characterize systems in chaos; these characteristics correspond to the experiences of persons confronting the continuing and prolonged crises associated with the uncertainty during a chronic illness. Mishel draws the comparison of prolonged uncertainty with far-from-equilibrium dynamics in which very small external changes can
affect profound internal changes within the system and the system can dramatically self-organize. Continuing this analogy Mishel theorizes that entropy, or the degree of disorder and disorganization in life, increases in persons who are in the midst of unabating uncertainty. Persons cannot withstand this mounting uncertainty and are pushed to a bifurcation point when there is either death or a change toward a more complex level of self-organization.

Vicenzi (1994) suggested that chaos theory could provide a new synthesis for nursing and community health; she was one of the first to relate the concepts of chaos theory to nursing theory and health-related phenomena. For example, she suggests that perhaps nursing intuition is a prereflective sensing of chaos and that heart rate variability, neutrophil counts, epilepsy, and schizophrenia exhibit chaotic dynamics. Sensitive dependence is a concept in chaos theory sometimes called the “butterfly effect,” referring to the phenomenon that small change can lead to extreme effects in the long term (p. 38). She relates these concepts to Rogers’ (1990) postulates of unpredictability and irreducibility, and suggests that nurse scientists might increase their use of longitudinal research designs and computer modeling to come to understand the wholeness and complexity of human patterning.

Ray (1994) situates her theory of complex caring dynamics within the context of complexity science and chaos theory. The foundations of her theory are in a relational ontology patterned by love. She states that “self-organization in chaos theory, although seemingly without a goal, is influenced by creativity—a vision of a purposeful love, a purposeful God, a force or spirit of life expressing itself intelligently in the universe” (Ray, 1994, p. 25). Ray argues effectively that the concepts of relationality, belongingness, holism, self-organization, human–environment integrality, patterning, stages of organization–disorganization stages, unidirectionality of change, and pattern recognition are contained within nursing and consistent with complexity theory (Ray, 1994, p. 25). Caring is defined as “the energy by which choice is facilitated to bring order (healing or well-being) out of chaos (disease, need, pain, or crisis)” (Ray, 1994, p. 26). Ray describes the caring relationship as an attractor that draws the system away from chaos and toward well-being and healing. In this relationship, the nurse instills hope, leading to choice making that changes the pattern so that both nurse and client are “more alive and authentic” than before (Ray, 1994, p. 26). She identifies four life pattern forms related to pattern seeing: technical, practical, critical, and creative caring dynamics. Each has its corresponding methodological frameworks for pattern mapping and integrative synthesis or pattern recognizing. The theory of complex caring dynamics highlights the primacy of relationships or love as the pull of the universe toward creative emergence or healing.

Turkel and Ray (2000, 2001) developed a theory of relational complexity that describes and explains the importance of caring in the complexity of
the current health care environment. The theory's assumptions flow from a unitary–transformative worldview embracing complexity, expanding consciousness and transformation, and ideas of paradoxical patterning and living changing value priorities within Parse's theory of human becoming (Turkel & Ray, 2001). They assert that the current health care environment is driven by the economic factors of regulation, reimbursement, and costs. This environment can influence nursing practice so that it becomes shaped by the demands of increasing patient acuity and time constraints imposed by increasing documentation and decreased staffing. This can lead to compromised quality and safety outcomes for patients, including well-being and quality of life. On the other hand, nursing places caring and relationship prominently within its discipline and profession. The seeming paradoxical forces of economics and caring must be reconciled through a codetermining relationship (interidentification), a transformation of quantity into quality (qualitative difference), the negation of negation (dialectic resolution), and a spiral form of development (transformation and change) (Turkel & Ray, 2001, p. 282).

Turkel and Ray (2000) propose that a shift in the self-organizing pattern of interrelationships among the nurse, administrator, and patient can change this dynamic. This shift occurs when caring and relationship become the organizing force for patterning. When this occurs, the nurse–patient–administrator relationship becomes an economic resource for the organization. They propose a synthesis of caring and economics that will result in fulfillment of the organization's mission, economic enhancement, actualization of the nurse–patient relationship to its full potential, and patient outcomes of enhanced healing and well-being. In Turkel and Ray's theory, human caring and economics are synthesized into relational complexity in an economic context in which the result is "ethical economic caring" (Ray, 1994, p. 50). This reflects the tenets of complexity science related to the edge of chaos, where the emergence of order from disorder can be found in a choice point and hidden unity becomes revealed.

**Complexity Thinking and the Future of Nursing Inquiry, Practice, and Education**

Complexity thinking is taking root and growing across disciplines; it can only continue to spread within the discipline of nursing, affecting nursing inquiry, practice, and education. In the past 30 years, nursing has recognized the importance of multiple epistemologies and philosophies of science. Complexity science is founded in an emerging worldview that contrasts with the traditional worldview that guides scientific inquiry. This emerging worldview (Table 1.1) will continue to guide inquiry within the discipline allowing for, perhaps even compelling, the use of multiple
methods of inquiry in understanding the whole of complex phenomena. Several authors (Koithan, 2006; Resnicow & Page, 2008) point to the advantage of chaos and complexity in offering a valuable explanatory model for public health research and behavior change, and the study of whole systems approaches to healing. The limitations of randomized clinical trials in understanding the depths of the human experience, the interrelationship of power and knowledge, and the participatory nature of knowledge generation are evident. However, randomized clinical trials and other methods of empirical inquiry have their place in answering important questions related to phenomena of concern to nursing. In the future, nursing will transcend the boundaries of qualitative/quantitative and traditional science/human science dichotomies to embrace methods that require multiple perspectives on a single phenomenon in order to understand it fully. This is a hermeneutic process used by Davidson (1988) and described by Wilber in his AQUAL or all-quadrant thinking as “the eye of the spirit” (Wilber, 1997). Through this process, the multiple perspectives are synthesized through the lens of the observer; meaning is cocreated between the observer and multiple sources of knowledge, and wisdom replaces knowledge development.

Nursing practice will incorporate complexity thinking in the development of practice models and through the use of technologies for practice. The complexity of the health care environment is at a critical point, exhibiting the characteristics of a system in chaos that is at or approaching a bifurcation point. At this choice point, nursing, the profession that holds the energy of love, relationship, and compassion, may present a path in which both caring, technology, and the realities of economics may be synthesized in harmony (Ray, 1994). This can be combined with attention to a high-touch/high-tech world of practice for nursing. For example, new technology at the bedside may provide a holistic narrative of what is most important to the person, including his/her preferred name, interests, culture, family, community, and what is meaningful. At the same bedside, there will be the integrated patient record, incorporating relevant and current data, and technology to enable the ability to access information and knowledge for providing safe, effective care. This attention to caring may be a stimulus for the higher order of caring in nurses (Clark, 2003).

The American Nurses Credentialing Center requires hospitals aspiring to or achieving Magnet™ status to have a professional practice model that reflects nursing theory. In this way, the practice environment is creating an alignment of nursing knowledge for practice. Nursing theories in the unitary–transformation paradigm reflect complexity thinking, and there is accelerated movement of these theories into the practice environment. For example, Watson’s Caritas Consortium is a group of health care organizations that are advancing caring-based practice models that reflect the tenets of
complexity, such as interconnectedness, creative emergence, and dynamism. Nurses in practice will be generating and testing the concepts within chaos and complexity thinking (Haigh, 2002).

Finally, nursing education will incorporate complexity science in its approaches to teaching and learning. The Carnegie Foundation report on the nursing education (Benner, Sutphen, Leonard, & Day, 2010) includes commentary on the chaotic, dysfunctional U.S. health care system and how nursing students must learn to function within it. The study found that nurses are undereducated for practicing in this chaotic health care system. For this reason, nursing educators will be challenged to prepare students for practice in complex environments. This will require abandoning a focus on delivering content and instead teaching students how to access and use knowledge in the context of dynamic patient care situations within complex systems. Nursing students need practice in clinical reasoning and clinical imagination, thinking through what can happen as changes occur in patient care situations, and creatively responding to these situations. In addition, nurse educators need to attend to the formation of the student as person. This formation requires the development of personhood and may involve the use of reflective and spiritual practices and aesthetic engagement. Such practices will expand awareness in order to better apprehend patterns of the whole and to live a compassionate practice. Benner et al. (2010) describe the importance of teaching ethical comportment, day-to-day living, and the essential values of nursing in practice. The necessary content and practice competencies must be embedded in patient narratives or stories. In this way, the nursing content currently taught is viewed within the context for promoting the health, healing, and quality of life for the person, family, and the community. The complexity of the nursing situation can be revealed through the story's details, and knowledge related to nursing science as well as pathophysiology and disease management can be integrated and explored within it. Students need to learn complexity thinking and how to understand and negotiate the complex environments in which they work. Skills for pattern seeing, systems thinking, and facilitating patient transitions will be essential for the future. Students will learn through simulations that can embed complexity within a safe environment. In a health care environment characterized by interrelationships and diversity, learning needs to occur with other professional students and with diverse communities.

Complexity thinking is penetrating the consciousness of many disciplines, including nursing. Martha Rogers described in 1970 a unitary worldview consistent with complexity theory, making nursing the pioneer in advancing these ideas. Other nursing theorists have followed, expanding complexity thinking in nursing. The concepts within the science of complexity will shape the future of nursing inquiry, practice, and education.
REFERENCES


1. What is the relationship between theory and practice (clinical, administrative or educational) highlighted in this chapter?

The most important relationship between theory and practice highlighted in this chapter is that found in the unitary-transformative or simultaneity paradigm as described in the nursing literature. This world view notes the human-environment as a unitary whole. As such, the theory is the practice, and may be said to happen or unfold via the direct perception of the nurse. As nurses, theory is the cognitive or conceptual framework that maps the terrain of our work and world. Practice is the lived experience of a certain perspective or theoretical world view embodied within the nurse. Theory is our way of organizing and bringing clarity to the process of living life and working with our patients. Practice is the direct experience of what works or does not work in the “field” of patient care. This constant interplay or daily feedback expands the awareness of the nurse exponentially, expanding consciousness with the emergence of new insights in a consistent, even rhythmic way, in relation to the intensity of the situations presented. Nurses enter into relationship with patients in times of crisis or “bifurcation points”. They are poised to help initiate shifts in the lives of persons who enter into a caring relationship with them.

In this chapter, Smith explicates the complexity of this relationship between nurse, patient, and environment. She traces the origins of what is fast becoming the “map” of choice across multiple venues including clinical practice, administration, and educational institutions.

In clinical practice, an example of this model of nursing care is displayed by nurses on a depression, mood disorder, in-patient hospital unit in a large tertiary care hospital in the Midwest. These nurses practice what is referred to as “relationship centered care” (Suchman, 2006) by putting the patient’s needs first. They also practice what is called “unitary-caring science” in nursing. Unitary caring science is described as a melding of Roger’s Science of Unitary Human Beings and Watson’s Transpersonal Caring Theory. They go about their work with patients modeling the complexity descriptions noted by Butcher (2002) as: 1) cultivating creativity, 2) using butterfly power, 3) flowing with turbulence,
4) exploring integrality, 5) seeing the beauty and art of nursing, 7) living in pan dimensionality, and 8) participating with the whole. Each of these themes describes a quality specific to complexity science but also to unitary caring science.

In administrative relationships, a complexity model of operating may be seen in the literature and in the style of management that encourages a non-hierarchal approach to problem solving and transformational leadership. Margaret Wheatley (2001) has been the spokes person for this creative venue that brings all participants to the table, giving voice to potential and emergent possibilities for resolving complex problems. Knowing the difference between simple, complicated and complex problems (Zimmerman, 1999) allows nurses the opportunity to choose the most efficient avenue for resolution, choosing to focus their efforts in paradigm I, II, or III as articulated by Newman et al. (1991).

In education, teaching complexity principles to student nurses brings light bulb moments in the class room as they grasp the implications of functioning with these essential guidelines alongside them. Complexity principles are “essential” in that all of nature follows the process mapped by complexity science. It inherently makes sense, and at the same time lends a refreshing and inspiring vision that uplifts the spirit. In this chapter Smith has managed to take an often overwhelmingly complex subject and revealed the path by giving us navigational tools to help make sense of our world and our individual roles in the global scheme of things. From the microscopic to the macroscopic or cosmic environment, from the quantum wave/particle to the path of stars and planets, all may be better understood as fractal elements of the universal design of our cosmos. The term “fractal” refers to the shapes and patterns found in nature that are iterative or repeat at all levels of design or dimension, each embedded within the one before. Information is shared, distributed in this way via a non local process as stated in complexity theory.

Nurses are constantly placed in situations that facilitate an accelerated learning curve as they walk 24/7 alongside their patients. As they choose to step into caring relationships with each other and with their patients, our world becomes a better place and we all become healthier people. In complexity science, nurses now have a map which affirms our historical nursing theories, yet also inspires a new and dynamic approach. As each nurse individually grasps the concepts and makes them his/her own, a new life and energy is brought to the fore. In complexity science, we have the patterns and dynamics that express how one can both express individually yet be globally connected and conscious in a deeply caring and inspired way.
2. How does a nurse or a physician or health care administrator learn about complexity science/s and caring through the presentation of ideas or research?

People expand their horizons of meaning by being in dialogue with one another. Truly listening or hearing what each other is saying is imperative. By learning something of the various cultural perspectives we enrich the dialogue and ourselves by being able to envision new possibilities or other ways of knowing and doing. The natural world demonstrates the unfolding of complexity principles, so paying attention and having the intention to learn is particularly helpful. There are many short videos available on line now to assist one in grasping graphically or visually principles that may be difficult if just the verbal description is offered. We are becoming a multi sensory population and there are tools that can be shared to open up these doorways for exploration. Indigenous people who think in images instead of words are showing us the way in many respects. Learning to pay attention to intuition, “feeling” dynamics, and subtle impressions brings the world to life in a way that objective rational thinking has left void.

3. What meanings are illuminated in this chapter for nursing or other health care professions? Direct your answer to education, administration, research or practice based upon the focus of the chapter.

The meanings illuminated in this chapter for nursing and other health care professionals are as follows:

a. Nurse educators must now teach about the world and nature as it really is, not as isolated phenomena but in context with many influences and dimensions to consider. We are to enjoy the process. In other words, we are to come from a place of love in the heart instead of fear. Surprising and amazing happenings unfold as we work in harmony and synchronicity with all that is. A resonance pervades that unifies our efforts in mighty ways. Native peoples would say that we follow the “beauty way.”

b. Nurse administrators need to avoid “top down” hierarchical models. They need to obtain input from the “bottom-up,” bringing all players to the table to make decisions, especially those who will be doing the work. More insight into problem situations comes into play when one includes outliers with unique perspectives. Outliers are seen as valuable players rather than irritations to be ignored as in the traditional paradigm of medical science or paradigm I in nursing. In Complexity dynamics we have a “both/and” philosophy in which each perspective plays its part. In all, workers take more responsibility for decisions that they have helped to create.
c. Nurse researchers must now resolve the paradox of duality perspectives with an expanded vision. Quantitative and Qualitative, reductionist and pluralistic measures, and many other qualities listed in this chapter co-exist each with their purpose, but we are rising to a new level of operating within ourselves. As consciousness expands individually, the collective consciousness also takes a leap. New research methods must be devised that actually speak to this new reality. We live in a quantum world that “leaps” to surprising solutions, no longer just using rational linear logic to explore our world.

d. Practicing nurses are embedded in the mix of patient dilemmas. Solutions emerge from constant feedback as new information is digested and recycled through creative applications to problematic areas. Nurses need to get used to change, be flexible, and become comfortable with uncertainty, learning to tap into “group mind” where solutions lay waiting for one who asks. Life takes on a vitality that can only come from needing to stay awake and on ones toes. Not at all the boring and tedious actions called forth under a predictable conceptual model of the universe. All becomes important and each is needed to do his/her part for the whole to radiate a mature persona of love and kindness.

4. **What is the relevance of this work to the future of the discipline and profession of nursing, health care professions and health care in general?**

Nursing, at its best, has always worked with the idea of compassion, which means to join with passion or enthusiasm into the endeavor at hand. Nurses facilitate well being or the healing process for and with others. Nurses have always been in full participation in that they walk along side their patients rather than act as hierarchical dictators of orders. Nurses are thus, ready to move forward with complexity thinking. As a group, nurses do not have energy invested in hierarchical power structures. Complexity Science coupled with caring dynamics seems to be our true language, our way of being in the world. We have always considered multiple options and avenues for exploration to help take us toward the focus of our attention and intention. That focus is to care for our patients, ourselves, and experience a harmony of wholeness and health of body, mind and spirit.

Complexity thinking is the venue that will allow us the quantum leap forward in our ability to solve previously inexplicable problems. Other health professions as they come to understand the dynamics of a complexity model will be more willing to engage with one another for
mutual benefit, each bringing the wisdom of their way of doing things. We will learn to work together and share the responsibility for our own health and healing along with that of our earth.

REFERENCES


The Science of Unitary Human Beings (SUHB) (Rogers, 1970), the conceptual system of the nursing theorist Martha Rogers, is its own unique science with its origin in the unitary nature of the human–environment mutual process. Nursing is a science and an art. “A science is an organized abstract system. It is a synthesis of facts and ideas, a new product” (Rogers, 1990, p. 6). A science has many theories. The mutual human–environment process is the focus of nursing; it is complex and often difficult to study. The abstract system of the SUHB exists as an irreducible whole. Definitions, principles, and theories derive from this irreducible whole. “The evolution of unitary human beings is a dynamic, irreducible, nonlinear process characterized by increasing diversity of energy field patterning” (Rogers 1990, p. 9). Thus, developing nursing's abstract system demands a new worldview, a language that has specificity, clarity, precision, and communication (Rogers, 1990). Although the Science of Unitary Human Beings is often directly compared with complexity sciences, I believe that the SUHB can be classified as different because of the unique principles that are espoused and the wholeness expressed in the life process as reflected in pattern manifestation and organization in the energy fields of humans and environment. Rogers did not use the language of complexity, such as chaos theory, complex adaptive systems, or from a physiological view, normal variability, or from a methods perspective, fractal analysis to identify or analyze fractal patterns and the interactive process that creates them. Rogers, on the other hand, advocated multiple naturalistic field methods or forms of inquiry to study phenomena within context, recognizing the unitary nature between the observer and the observed or that the knower and the known are one (Reeder, 1984). Rogers (1990) used the revised homeodynamic principles of resonancy, helicy, and integrality to understand and study the continuous human and environmental process (p. 97). “Resonancy refers to continuous change from lower to higher frequency wave patterns in human and environmental fields. Helicy refers to the continuous innovative, unpredictable, increasing diversity of human and environmental field patterns. Integrality refers to continuous mutual human field and environmental field process” (Rogers, 1990, p. 8). These principles provide a fundamental guide to the study and practice of nursing. The SUHB begins with the unitary nature of humans in the environment, which is in mutual process and continuously
moving forward. The increasing complexification of energy field patterning shows that there is no generalization from parts to whole (Rogers, 1990). Outcome subsequently is not the origin, nor is the science a stimulus–response system, nor is it divisible into parts. Consequences or conclusions although may be captured as pattern outcomes in research, however, are not applicable in the strict sense of the words. Thus complexity science, although illuminating the relationship networks or the tenet of interconnectedness, is different from Rogerian science.

Philosophically, Rogers’ SUHB is essentially unitary. Its essence of meaning always begins with the unitary nature of the human and environment in mutual process, which is continually open to pattern change. As a unitary mutual human–environment process, complex patterns become manifest as humans and their environment dynamically evolve; they are unpredictable and increasingly diverse.

From an inquiry perspective, complex ways of knowing are manifest and unfold in the real world. The SUHB always encompasses the ever-changing human–environment integrality, including the environment, for example, of space. Rogers reinforced the phrase advanced by Robinson and White (1986), home spatialis, to illuminate the ever-changing human–environment field patterning. Complexity, thus, is interpreted through a lens—a telescope to look at humans in a real-world mutual process. These manifestations are experienced in practice, studied in research, and communicated in education.

APPLICATION OF THE SUHB IN NURSING RESEARCH, EDUCATION, AND PRACTICE

Unitary field pattern methods or the study of pattern manifestations have been advanced by Rogerian scholars, such as Rawnsley, Butcher, and Cowling (Madrid & Barrett, 1994; Locsin & Purnell, 2009). Complex field patterning manifestations of the human–environment mutual process in practice can be interpreted by nurses through education, research, and practice. Nurses are not separate from patients; they are in an integral relationship manifest as integral evidence. Persons intended are ever changing, never static, transcendent as well as immanent, and potential as well as actual; as such, preference is given to wave-seeing (whole) rather than particle-seeing (parts) consideration or judgment in the world. The benefit of understanding integral evidence “. . . holds promise for the development of pattern seeing of wave phenomena” (Reeder, 1984, p. 21) in Rogers’ Science of Unitary Human Beings. The integral evidence, observational statements or communicative phenomena of “consciouing the world” or manifesting intentional consciousness, can be, for example, energy as felt, healing as imagined, health as remembered or health as desired, pain as avoided, and action as judged.
The integral evidence includes not only five sense perceptible things but also phenomena such as willing, loving, judging, imagining, remembering, intuiting, feeling, and anticipating (Reeder, 1984). Learned pattern seeing in nursing adopting the SUHB for research, education, and practice must come from a centered perspective of knowledgeable compassion. “art, wisdom and compassion, underwritten by transcendent imaginative conceptual skill index the ways of knowing that are integral to this unique science of nursing” (Reeder, 1984, p. 23). Knowledge and wisdom thus are lived uniquely by the knower and the known (Mitchell, 2009). Rogers taught us to appreciate that “as individuals attune to a unity consciousness [the unity of the knower and the known], infinite possibilities are born, and the status of finite consciousness disappears in the beauty and flow, revealing a kaleidoscope of patterns that are ever-changing” (Cowling & Repede, 2009, p. 78). As Einstein revealed, the most beautiful thing that we can experience is the mysterious; the source of all true art and science is the mysterious (Madrid & Barrett, 1994, xix). In nursing, we hold this beauty and mystery in our hands, hearts, and minds through knowledge and the wisdom of Rogers’ incomparable Science of Unitary Human Beings.

REFERENCES
CHAPTER 1
PHILOSOPHICAL AND THEORETICAL PERSPECTIVES RELATED TO COMPLEXITY SCIENCE IN NURSING

- How do you see the work of Martha Rogers’ science (the Science of Unitary Human Beings) influencing contemporary health care practices?
- Do you see Martha Rogers’ work more congruent with caring science or complexity science?
- How do you see caring science and complexity sciences guiding your professional practice? Discuss some concepts from Watson’s “Caritas” theory and the Science of Unitary Human Beings. Are they comparable?
- In the response, Dr. Perkins defines “fractal”; what shape or pattern found in nature best describes your professional work environment?
- In the response, Dr. Perkins talks about the importance of integrating concepts from complexity into education. What education would your peers need to make the connection between the theory of complexity sciences and professional practice?
- In the response, Dr. Reeder speaks of Rogers’ Science of Unitary Human Beings. What does unitary mean to you both from a Rogerian point of view and how you have developed the idea?