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# COMPLEXITY: The SCIENCE OF RELATIONSHIPS

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“....the next century will be  
the century of complexity.”

(Steven Hawking, 20<sup>th</sup> Century)



# What is Complexity Science?

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- ❖ The Most Current Attempt By Science to:
  - ❖ Understand and explain the behavior and dynamics of systems composed of many interacting elements
  - ❖ Uncover the principles and processes that explain how order and change emerge in these systems

# What is Complexity Science?

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## ❖ Interdisciplinary Science

- Biology
- Economics
- Sociology
- **Nursing**
- Mathematics
- Physics
- Anthropology
- Management
- Medicine

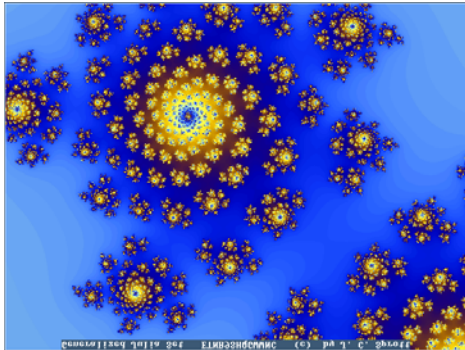


# What is a Complex Adaptive System?

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## ❖ System implies:

- ❖ Multiple Agents
- ❖ Agents are Interdependent and Connected



## ❖ Complex implies:

- ❖ Diversity
- ❖ Many Elements
- ❖ Large Number of Connections

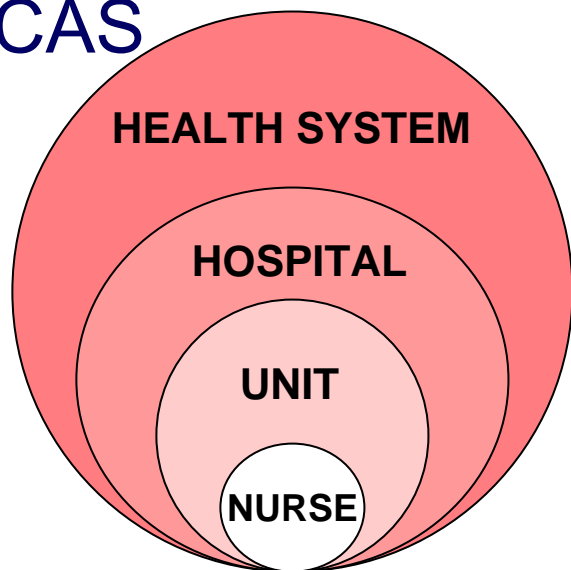
## ❖ Adaptive implies:

- ❖ Capacity to Alter or Change

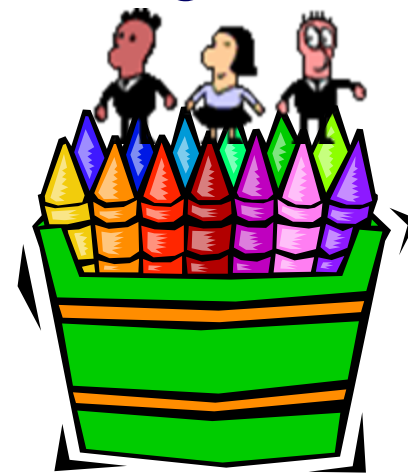
# Properties of CAS

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- ❖ Embeddedness: Each CAS made up of other CAS and is part of (embedded in) a larger CAS



- ❖ Diversity: A CAS has many different elements. This enables the CAS to adapt or change

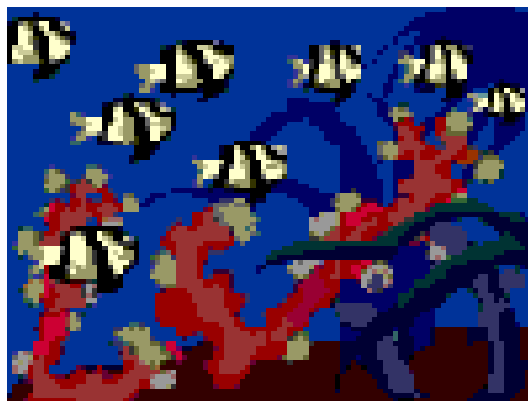


# Properties of CAS

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❖ Distributed Control: In a CAS control is shared by many elements, rather than centralized in a single command center

❖ Coexistence of Order and Disorder: In a healthy adaptive system, order and disorder coexist



# Properties of CAS

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- ❖ Because CAS are Nonlinear, a small change may produce a large effect, or a large change may produce a small or no effect, hence
- ❖ Outcome are Inherently Unpredictable



The Butterfly Effect

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# Properties of CAS

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- ❖ Emergence: In a CAS outcomes emerge through a process of Self-Organization rather than through planning and managing or directing processes





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**“Complex Adaptive Systems live  
in areas of bounded instability on  
the border or edge of chaos”**

**[Zimmerman, Lindberg & Plsek, 1998]**

**Cells, Organs, Patients, Families,  
Communities, Nurses, and Healthcare  
Systems are all Complex Adaptive  
Systems**

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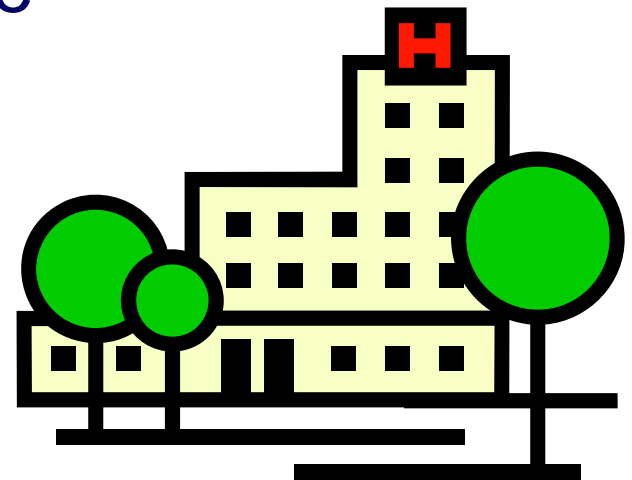
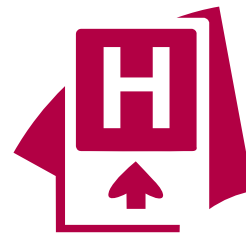
# Nursing: The Profession of Relationships

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❖ Complexity Science helps us understand and work creatively

- ❖ With patients with multiple chronic diseases
- ❖ In our interactions with patients, families
- ❖ To improve healthcare quality
- ❖ In teaching students

❖ Complexity Science helps us understand and work with individual and system change



# Complexity Resources & Research For Nursing

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Nursing Services

Ruth Anderson, PhD, RN

Duke University School of Nursing

Nursing Services

Linda Rusch, MSN, RN

Hunterdon Medical Center, Flemington, NJ

Physiology

Ary Goldberger, MD

Harvard Medical School

Curriculum

Claire Lindberg, PhD, RN

The College of New Jersey, Ewing NJ

Health Service Design  
& Quality

Marilyn Rymer, MD

Stroke Center, St. Luke's Hospital

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# Plexus Institute Activities For Nursing

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- ❖ Complexity & Nursing Learning Network
- ❖ Complexity & Clinical Practice Learning Network
- ❖ Complexity Science: Opportunities for Nursing Education – University of Kansas School of Nursing – August, 2005



Visit Plexus at:  
[www.plexusinstitute.org](http://www.plexusinstitute.org)

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